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CIRCULAR NO. 2.

OF THE

LOUISIANA CROP PEST COMMISSION.

PROCEEDINGS

OF THE

SECOND ANNUAL MEETING

LOUISIANA

Boll Weevil Convention

HELD AT

Shreveport, Louisiana,

Nov. 3d and 4th, 1904.

COL. CHARLES SCHULER, of Keachie, La., President.
R. E. L. GILES, of Shreveport, La., Secretary.

Issued by the State Board of Agriculture and Immigration.
J. G. LEE, COMMISSIONER

BATON ROUGE:
THE TIMES, OFFICIAL JOURNAL OF LOUISIANA.
1904.

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CIRCULAR NO. 2.

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SECOND ANNUAL MEETING

NOTICE.

Copy of Prof. J. H. Connell's address before the Boll Weevil Convention was not received by the printer in time to be inserted in the proceedings of the convention. The address appears as an appendix to this book.

Issued by the State Board of Agriculture and Immigration.

J. G. LEE, COMMISSIONER.

BATON ROUGE:
THE TIMES, OFFICIAL JOURNAL OF LOUISIANA.
1904.

SECOND ANNUAL CONVENTION
OF THE
Louisiana Boll Weevil Association,
HELD AT SHREVEPORT, LA., NOV. 3D AND 4TH, 1904.

FIRST DAY.

MORNING AND AFTERNOON SESSIONS HELD IN THE OPERA HOUSE.

MORNING SESSION.

The convention was called to order at 10:30 o'clock by Col. Charles Schuler, of Keachie, President of the Louisiana Boll Weevil Association. Prayer was offered by Rev. William E. Boggs, of this city, after which Judge John C. Pugh delivered the address of welcome in lieu of Hon. Andrew Querbes, Mayor of the city who was unable to be present on account of pressing business.

Judge Pugh cordially welcomed the visitors in a few well chosen words. He said:

"The present convention is one of the most important that has ever met in the history of the State since the convention which met in 1860 to determine whether this State should secede from the Union.

"The pest known as the boll weevil has invaded our State, and threatens to destroy one of our greatest industries—our cotton crop. Our people have heard of the great devastation wrought in Texas by the presence of this pest, and last fall some of our planters attended the great boll weevil convention which convened at Dallas, Texas, and at which the Commissioner of Agriculture of the Federal Government, the Hon. James Wilson, was present.

"It is needless for our people to underestimate the magnitude and importance of this question, and all conservative men who have the welfare of our State at heart, should co-operate together with a view of mitigating the evil.

"The convention at Dallas resulted in a call by the Governor of this State for an extraordinary session of the Legislature. At this session, the Crop Pest Commission was organized, with a view of dealing with the subject, as well as with other insects calculated to injure our agriculture, and the sum of $25,000 was appropriated to carry on the work of the Commission. The last session of the Legislature also made ample provision for pushing the work of the Commission.

"The work to be accomplished in this State should be carried on under the direction and supervision of this Commission, which is composed of conservative men fully qualified to deal with the subject.

"The prosperity of the cities depend upon the farmers. In order that the cities may grow and prosper, it is necessary that the agricultural portion of the country produce a rich harvest, and upon the farmers' plow depend the future growth of this city.

"This city has developed from a small trading point to a great commercial center, with fifteen miles of well paved streets and a magnificent city railway service.

"It is to be hoped that when the sun shall have gone down on the finished work of this convention, that some solution will be suggested that will enable our people to continue the cultivation and production of cotton.

"Our business people have contributed liberally to entertain this convention, and in behalf of its officials and citizens, we bid you a most cordial welcome."

In response Mr. W. E. Glassell, President of the North Louisiana Cotton Planters' Association, said:

"*Mr. President and Members of the Convention, Ladies and Gentlemen*:

"In accepting the commission given me to respond to the able address of welcome by our worthy Mayor on this occasion I did so feeling my inability to do justice to the importance of this great meeting, a meeting fraught with more vital import in my opinion than any gathering ever before assembled in proud and aggressive Shreveport.

"It is to this proud and aggressive all-American spirit of our people that this meeting was made possible, and it is the never-surrender spirit which has caused so many of the representative citizens of our great State to be here to-day.

"Mr. President, we have met here on this occasion to bring together the combined scientific thought of our great country, so ably represented by yourself and your splendid coworkers, and 'the man behind the gun'—the American farmer—in the glorious effort, not of laying waste to some foreign country, amid the pomp and circumstance of war, but to wage stubborn, relentless warfare upon an insidious foe which now seeks to set his destroying foot upon our fair shores and with a mighty sweep desolate our snowy fields, bringing to tumbled nothingness the tenements of our hopes and our ambitions. This foe, gentlemen, it is hardly necessary to say, is known as the Mexican Cotton-boll Weevil, and it is against his encroachments that we are met here to combat, not with the hope of exterminating him, but with the determination of the Caucasian race to fight that which is detrimental to our interests.

"Let us consider for a moment what this means to us. Let us try and comprehend, if we can, the relations existing between King Cotton and Queen Shreveport. The cotton crop of the South this year, aggregating nearly eleven million bales, will net her in round numbers a half billion dollars. This immense treasure is drawn from the coffers of the entire world. From the proud potentate of the effete East, monarch of all he surveys on his Isle of Palms, to the wily Jap now engaged in a death struggle with the Shaggy Bear; from the proud beauties of the Court of St. James to the treacherous Filipino with his cigarette and his 'tired feeling.' Of this great treasure the Queen City of the Southwest, happy, prosperous Greater Shreveport, reaps the handsome sum of nearly twenty million dollars. The Mexican Cotton-boll Weevil wants that twenty million dollars and unchecked he is going to take it, but, representing the planters of this section, which I have the honor to do on this momentous occasion, I quote the words of a famous man, who said: 'Millions for defense, but not a cent for tribute.'

"We are going to fight. And we have met here now to hold a counsel of war and determine on plans of campaign—map out a course of operation based on past experience, and co-operate with each other as closely as local conditions and circumstances will permit. Following this line I will view briefly what Louisiana has already done since the last convention.

"At the convention held in New Orleans not quite one year ago, every man present insisted that it was criminal negligence to not make a decided effort to check the spread of the weevil. The result of that convention was the calling of a special session of the Legislature and the organization of the Crop Pest Commission.

"The efforts of the Commission in Louisiana were directed along the line of determining to what extent this State was infested, and in organizing an educational campaign that, should the habits of the weevil be as local as they were thought to be, extermination by one year out of cotton, and a rigid quarantine would have given the State unqualified protection.

"The area infested was determined by July and from then until August no change in the situation transpired.

"It was in the latter month that the migratory habit became evident, and for the first time in the history of the boll weevil investigation was the migratory phase of the weevil's life definitely determined. Since then every effort has been made to trace the spread due to this August flight, and at present the western edge of the Red River valley has been reached and all the territory to the west of this is involved. This condition presents a serious phase; yet how unfortunate would it have been had these investigations not been made and the planters of this State given no time to prepare for the inauguration of the more successful methods of growing cotton with the weevil present. It is just here where the State has been saved its millions. Every interest has time to prepare, and should active co-opration prevail Louisiana will go on raising cotton and her industries dependent upon a good supply of this product will be protected.

"The Departments of Agriculture of the State, assisted by the United States Departments, will help the planters in their fight provided we make proper efforts to help ourselves. The success of any enterprise depends upon active and intelligent effort.

"About a year and a half ago when the boll weevil was first being seriously discussed by the planters of North Louisiana, Professor H. A. Morgan made several trips here, addressing the business men at the Board of Trade on that subject. So far what has been done in Louisiana is the direct result of the united efforts of the planters of this State, supported by the active and intelligent work of Professor H. A. Morgan. We feel that not only the planters of this State, but those of all the other cotton producing States owe him a debt that can never be fully paid. In his efforts as Secretary of the Crop Pest Commission to fight the weevil he has been untiring, courteous and prompt in replying to all inquiries, always giving attention to any complaint and assisting in overcoming the many difficulties attending a strict and vigorous quarantine.

"The Commission has conducted an active, aggressive campaign, resulting in the distribution of valuable information about the Mexican Boll Weevil. Capt. B. W. Marston, a member of the Commission, has been fighting the weevil in the State of Texas and through his efforts much valuable information has been gained.

"It is now the duty of the banker, the merchant, and everyone living in this State, to join in the defense and assist the cotton producer in his fight against the Mexican Boll Weevil. To succeed, thorough organization is absolutely necessary. A good General gets his forces well equipped and drilled when about to meet the enemy, but the man 'behind the gun' must do the work; he must follow the directions of the experienced General and put in practice the very best methods; his success depends upon concerted and intelligent action.

"It has been said that the farmers will not stand together on any proposition. My experience has been to the contrary. When the farmer is thoroughly convinced that his interest can be protected by uniting they will come together and carry out a plan of action to protect their interest. Should there be any difference in the methods employed by the scientist and the practical side it should not interfere with any work that leads to the destroying of the weevil. Different localities may suggest different conditions; what may be necessary in the hill lands may not suit the river district. The varied character of lands on the river may require different treatment. In this section our farmers may be divided in three classes.

"1st. A good farmer who owns his land and will cultivate the land, adopting the very best methods.

"2d. A good farmer who pays a liberal rent for land, his effort being to get all he can out of the land at the least expense to him.

"3d. A farmer who owns land, but cares little for improvements and will not cultivate his land properly, his only object, the present.

"In this campaign against the weevil it will require the co-operation of all three of these classes and in order to reach them forcibly the banker, merchant and planter must get together and insist on instructions being carried out.

"In this section we find the lawyer, doctor, banker and merchant as land owners; some rent their land, others cultivate. All of this class of land owners must join in the fight against the boll weevil if we expect to succeed. The continued prosperity of the country depends upon the kind of reception we are to give the Mexican weevil. It is un-American to run: fight we must, and fight we will: our homes, our lands, our positions commercially require it.

"This is the dark side, gentlemen, and in my zeal to elicit your interest it may be that I have presented it possibly a little more forcibly than you would like to hear, but hardly no more so than the conditions confronting us seem to warrant.

"In turning to the other side—taking the hopeful view—we do not by any means consider that we are engaged in a forlorn hope in this contest. It is a precept born and bred in us that Americans do not make a losing fight, and it is this that nerves us to the coming battle with the assurance that we will not lose. Past history of this fight under most adverse and crude conditions teaches us that the boll weevil can be checked. What has been done can be done again, and what should we not be able to do with the benefit of the experience of the Texas people who have been fighting the weevil, together with the combined experience and research of the ablest scientists of the country?

"An eminent New York politician (and they are said to be the best in the world) once said that there were only three elements to success. The first was 'assurance;' the second was 'assurance,' and the third was 'assurance.'

"He was right. We have the assurance that we will win this contest, and taking with this the earnest, zealous co-operation of all our people in the thorough and systematic application of known and tried methods, we cannot, we must not lose, but instead we will continue in the production of that staple which has made this country great and which is destined to make it greater, leaving to our posterity the priceless heritage of the fairest, the dearest country upon which the sun ever shone."

At the conclusion of Mr. Glassell's speech, H. C. Stringfellow, of Red River parish, made a motion that a recess be taken until 2 o'clock, stating that a large number of delegates would arrive during the noon hour, and he thought it due them to wait for their arrival. The attendance would be larger, and the session be more interesting.

Before the motion was put, Secretary R. E. L. Giles announced that Prof. J. H. Connell, of the Texas Farm and Ranch, had not yet arrived, and for that reason would not be on the program on the opening day of the convention. Professor Connell is expected to arrive to-day, when he will read a paper on "Effect of the Boll Weevil Upon the Agricultural Operations in Texas."

The motion to take a recess carried.

AFTERNOON SESSION.

The convention reconvened at 2 p. m. President Schuler announced the following committees:

RESOLUTIONS—W. L. Foster, Caddo; J. F. Lucius, Saline; J. M. Sentell, J. E. Adger, Bossier; L. S. Frierson, DeSoto; J. A. Prudhomme, Natchitoches; Y. C. Palmer, Vernon; J. W. Bolton, Rapides; W. B. Hunter, Dr. S. A. Knapp, United States Agricultural Department; H. C. Stringfellow, Red River; F. L. Maxwell, Madison; W. P. Theus, Bienville; Congressman J. E. Ransdell, Lake Providence.

ORGANIZATION—W. E. Glassell, J. B. Ardis, J. M. Parker, J. C. Pugh, Major J. G. Lee, William Polk, Henry Von Phul.

PRESIDENT'S ADDRESS.

President Chas. Schuler delivered his addess, which was as follows:

"Before declaring the session of this convention open for the regular order of business called for by the program, I think it proper to say a few words as to the causes which brought the Louisiana Boll Weevil Association into existence and the object of holding this convention at this time.

"Something over a year ago a number of North Louisiana cotton planters residing mainly in the Red River Valley adjacent to Shreveport, accompanied by Dr. W. C. Stubbs, Director of the Experiment Stations of this State, and Prof. H. A. Morgan, State Entomologist of the University at Baton Rouge, attended a convention at Dallas, Texas, composed of men from all parts of that great State, connected with the handling of that great staple, cotton, and its by-products, seed, meal and hulls. Hon. James Wilson, the patriotic Secretary of Agriculture at Washington, who has done so much to improve and build up the agriculture of this whole country, accompanied by such chiefs of bureaus of his department as in his judgment were needed were there and took part in the proceedings. All were present having but one end in view, i. e., to lend their aid in solving the danger threatening the profitable growing of cotton in a great portion of that State by the rapid spread and damage caused by that insect pest known as the Mexican Cotton-boll Weevil.

"The Louisiana delegates were so much impressed with what they learned on that occasion that they thought it would be a wise policy on the part of the Louisiana cotton growers to prepare themselves to combat the probable near invasion of our State by that pest. You all know the result. Gov. Heard was requested to call a convention in New Orleans, which he did. The convention held in New Orleans was composed of men representing the varied cotton industries of the State.

"The efforts of the convention resulted in the calling of an extra session of the Legislature, which body after mature deliberation created the Louisiana Crop Pest Commission, giving it extraordinary powers to take such steps as in their judgment would protect the cotton fields of our State from the invasion and spread of that much dreaded insect.

"It was during the meeting of the New Orleans convention that the Louisiana Boll Weevil Association was organized, its object being to assist the State authorities as best it could to make the profitable growing of cotton an assured success in spite of the presence of the weevil in our cotton fields.

"The Crop Pest Commission, after a season's faithful service found that the invasion has not been prevented, but owing to the migratory habits of the insect it has been located fully thirty miles eastward of the line formed last spring, seriously threatening the magnificent cotton growing lands lying between Sabine and Red Rivers, and suggesting that in the near future profitable growing of cotton by present methods may become extremely hazardous, and further, that unless checked by some as yet unknown method, the probabilities are that it will be but a few years when all of the cotton fields in our beloved State will become infected by the insect.

"Realizing the gravity of the situation the Crop Pest Commission at its recent meeting in Baton Rouge requested me to call this Association together, not to alarm the people, but to prepare ourselves for what is to come.

"Texas, assisted by the Department in Washington, has carried on experiments showing that by adopting certain methods cotton can be profitably grown in the infected portions of that State. Gentlemen engaged in these investigations and experiments are with us to-day. Planters, merchants and bankers in Texas, who have been face to face with the problem, have kindly volunteered to give us their experience. Planters and scientists from this State are here to tell us how to grow cotton profitably in spite of the presence of the boll weevil.

"Gentlemen of the convention, by a united and intelligent effort we can do a great deal to sustain confidence of capital and labor, those two ingredients so necessary to the growing of cotton in this State.

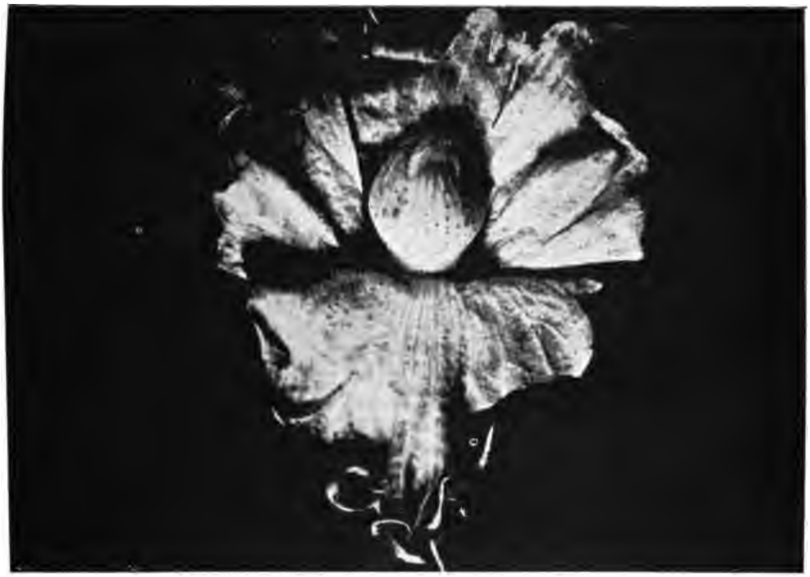
"I leave the problem with you, having no doubt that as patriotic citizens of this great State you will do as best you can."

Dr. W. D. Hunter, in charge of the boll weevil investigations, United States Department of Agriculture, delivered a very interesting paper based upon investigations of the United States Department of Agriculture, Bureau of Entomology. Dr. Hunter said:

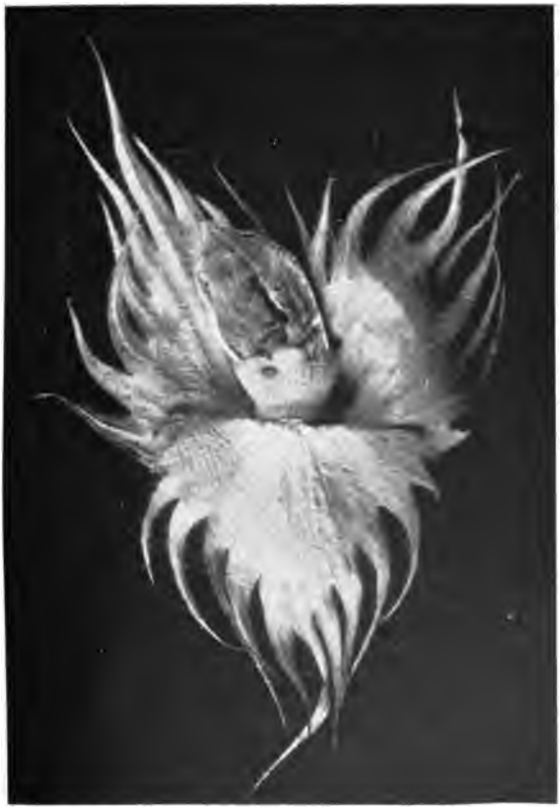
"In order to place before the members of the convention the origin and development of the recommendtions the Department has been making in Texas, it will be necessary to enter briefly into the history of the work. The boll weevil first came into Texas about 1892. In 1894 it had spread to half a dozen counties in the extreme southern portion of the State, and in that year was brought to the attention of the Bureau of Entomology as an important enemy of cotton. An entomologist was immediately sent to the infested territory. His report, the first authentic statement regarding the pest, was published in March, 1895. The seriousness of the prospects, as far as the cotton planters of Texas were concerned, was fully realized by the Bureau of Entomology, and the evidence of the last few years have verified the production in regard to the annual advance made and the damage caused by the insect. At this time Dr. L. O. Howard, Chief of the Bureau of Entomology, after due consideration and in view of the damage to be expected, recommended the rather drastic measure to the legislature of Texas of establishing a zone along the Rio Grande in which the cultivation of cotton should be prohibited in order to cut off the advance of the insect. At that time it was impossible to cause the people of Texas to realize the danger that threatened the production of their most important crop, and no action was taken.

"The additional territory invaded by the pest was watched carefully by entomologists during the year 1895. Recommendations based upon the observations of this and the preceding seasons were published by the department in circulars in both English and Spanish editions. In 1896, owing to climatic conditions in regions uninfested, which have since that time been duplicated, there was very little extension of the damaged territory. It should be stated in this connection that the region from San Antonio, Texas, to Corpus Christi, Texas, and thence to Brownsville, will frequently pass through similar experiences, which will be quite different from anything that may be expected to occur in regions where the rainfall is more uniform. In 1897, in spite of a rather unfavorable season, the insect increased its range considerably. At this time the evident importance of the matter caused the Department to station an entomologist in the supposed original home of the insect in order to discover if there were any influences there which might be encouraged artificially in Texas in order to reduce the numbers of the pest. It is a general rule in such matters that the most likely region in which to find effective parasites of an injurious insect is in its native home, where nature has had time to establish an equilibrium and reduce the excessive numbers of certain forms. Unfortunately nothing was found in Mexico which gave any hope of material assistance in the warfare against the weevil. In 1898 a number of additional counties became infested and the results of the investigations were published by the Department. At this time the State of Texas for the first time, appointed an entomologist and made a limited provision for the investigation of the pest. In view of this fact the Department of Agriculture discontinued temporarily the work that had been carried on by having agents in the field almost constantly for almost four years. However, the insect continued to spread, and it soon became certain that other States than Texas were about to become invaded. This caused the work to be taken up anew in accordance with a special appropriation by Congress with special reference to the discovery, if possible, of means to prevent the spreading of the insect into other States. In accordance with this special appropriation, the writer was sent to Texas in March, 1901. He carried on co-operative work upon several of the larger plantations in the infested region. This work was suggested by previous observations and experiments, and was designed to perfect a system of raising cotton where the boll weevil exists. One result of the work of this season was to suggest the advisability of a considerable enlargement of the scope of the work, the need of a means of testing the recommendations of the Bureau of Entomology upon a large scale, and thereby furnishing natural demonstrations to the planters, became apparent. Consequently, provision was made by Congress for an enlargement of the work. The following season (1902) agreements were entered into with two large planters in typical situations for testing the cultural system of controlling the pest upon a large scale. In this way 125 acres at Victoria, and 200 acres at Calvert were employed. At the same time the headquarters and laborotory of the investigation were establisheed at Victoria, and such matters as parasites, the possibility of poisoning the pest, or of destroying it by the use of machines, were given careful attention. Results of the field work of this year were published in the form of a Farmers' Bulletin, entitled, "Methods of Controlling the Boll Weevil. Advice based on work of 1902." At this time hearty co-operation was carried on with the Commission established by the Mexican Government for the investigation of the boll weevil in that country. Dr. L. O. Howard, Chief of this Bureau, and the writer visited the laboratories of the Mexican Commission and obtained specimens of parasites which seemed to be of some little importance.

"The favorable reception by the planters of Texas of the experimental field work conducted during 1902, with the increased territory invaded by the pest, brought about an enlarged appropriation for the work of 1903. By an enactment which



Square Showing External Appearance of Two Egg Punctures.



Wart Formed on Side of Square in Healing of Egg Puncture.

became effective on the 4th of March, 1903, $30,000 was placed at the disposal of the Bureau of Entomology. It thus became possible to increase the number and size of the experimental farms, as well as to devote more attention to the investigation of matters suggesteed by previous work in the laboratory. Seven experimental farms, aggregating 558 acres, were accordingly established in as many distinct cotton districts in Texas.

"The situation up to the present year may be summarized by stating that the Bureau of Entomology had accomplished the following results:

"1. A rather complete knowledge of all the details of the life history of the boll weevil was accumulated. Upon such knowledge, of course, only can judicious methods of avoiding damage be based.

"2. A cultural system of controlling the pest based upon the knowledge that has just been mentioned was perfected and brought to demonstration at many localities in Texas.

"At present the method perfected by the Bureau of Entomology which is now commonly known as the cultural system, may seem quite simple. Take, for instance, the recommendation of early planting. From the fact that the boll weevil feeds upon no plant other than cotton, it might be supposed that the proper way of fighting it would be to plant late, thereby increasing the death rate during the winter, instead of planting early. In order to determine which process was the better, early and late cotton had to be planted alongside of one another in different situations and during different seasons. The same method of repeating tests was followed in regeard to all the various other steeps in the present cultural system.

"At this time a great impetus was given to the recommendations of the Bureau of Entomology by the Dallas Boll Weevil Convention, which took the matter up energetically through organizations of business men everywhere, and caused the proper system of raising cotton in spite of the boll weevil to become well known.

"This brings the history of the boll weevil work of the Department of Agriculture down to the present year. During the latter part of last season the Secretary of this Department visited Texas in order to learn by personal observation what might be done by the Government to relieve the situation. As the result of these observations in Texas and the systematic and hearty co-operation of members of Congress from Louisiana and Texas, a special appropriation of a quarter of a million dollars was made in order to continue the work that had been started by the Bureau of Entomology, and also to carry on a propaganda system in order to bring the cultural system to the attention of as many farmers as possible. Accordingly the Secretary decided to increase the number of experimental farms where the modifications of the cultural system which were necessary in certain quarters might be continued, and to generally enlarge the scope of the work of the Bureau of Entomology. In addition to this direct work with the boll weevil, the authorities at Washington considered that more might be accomplished in one year by demonstration farms in actual operation before the eyes of the farmers in one season, than by the publication of any number of bulletins during a long series of seasons. Accordingly, a system of demonstration or sample farms was inaugurated under the direction of Dr. S. A. Knapp. The idea in this work was not to spend portions of the appropriation, but to cause farmers everywhere to make use themselves of what was already known about combating the pest. In this way at least 5,000 planters in Texas and Louisiana have, during the present season, carried on co-operative work, and thereby become thoroughly familiar with the results of previous investigations and the necessity of certain modifications of the system of raising cotton made necessary by the boll weevil. The decided success of this work under Dr. Knapp's management, which has attracted attention everywhere, has been not only a feature of the Government's campaign, but something entirely unique and unprecedented in the history of agriculture.

"In consequence of all this work we have a system of fighting the pest based upon thorough investigations of its life history, which has repeatedly been tested by the Bureau of Entomology upon a large scale, under conditions, in many cases, similar to those in Louisiana, and which has, during the present season, been brought into practice without scientific supervision by fully 5,000 farmers in Texas.

"It is not believed by the writer that the planters of Louisiana fully realize the great advantage they have over the planters of Texas, in consequence of the great amount of work which has been done in the latter State, and which must now result directly for their advantage. It is true that there are some differences between the conditions in Louisiana and Texas, but nevertheless, persons conversant with both States have found but little essential difference between the labor and other conditions. In the Brazos Valley in Texas, for instance, and the river lands like the valley of the Red River in Louisiana. In illustration of this point, it may be stated that recently two prominent Louisiana business men visited the State of Texas in order to obtain data which would enable them to change their business methods in Louisiana if such should become necessary with the advent of the boll weevil. In a statement issued by these gentlemen, which is in the writer's hands, he reads:

" 'Seeing that none of the above black land prairie is similar to Louisiana or Mississippi in soil or labor conditions, we went to Hearne, on the Brazos River, where we found the exact conditions that we are accustomed to—sandy hills bordering alluvial lands of the finest quality and presenting all the features of our sandy, mixed and stiff river bottoms; all cultivated by large planters, handling from 1,000 to 4,000 acres, working principally negroes and a few Italians. The tenant and wages system, the same as ours, is in vogue here.

" 'Our investigation of these sandy and mixed lands lifted our spirits to the highest point, for here we at last found a crop where weevils were thick, with every one confident they could do as well, or better, another year. We saw no crop under one-third of a bale, and up to three-fourths of a bale to an acre; most of them were making one-half a bale to the acre on these sandy and mixed lands.'

RECOMMENDATIONS.

"The planters of Louisiana must realize that the boll weevil must be reckoned with as a permanent factor in cotton culture, and must take advantage of what has been learned by the, in many cases, disastrous experience of Texas planters. It will be decidedly to the advantage of any Louisiana planter who can afford it, to spend some time in Texas during the coming season, studying the conditions and visiting many of the towns in the State which are still prosperous despite the devastations of the boll weevil. There is at present something of a tendency towards too much fear of the weevil in Louisiana. The experience of Texas indicates that the production of cotton in the State can be maintained as before, although some changes will be necessary. In the case of any planter, whether he can visit Texas or not, he should procure from the Department of Agriculture the various bulletins which have been issued on the investigations that have been made, and containing the results of actual field work on a large scale in many localities in Texas. In these bulletins you will find a substance of all that is known relative to fighting the pest.

"Perhaps the most important point to be impressed upon the minds of the planters of Louisiana is the necessity of procuring an early crop. In order to accomplish this more labor than ordinary is needed, or as it might be better expressed, the same labor should be applied to smaller acreages. It must be confessed that at present there seems to be no escape from the reduction of the cotton acreage in Louisiana. If the tenant at present works twelve acres of cotton, it will be necessary for the amount to be reduced by about one-quarter. To continue the industry profitably, it will be necessary to practice more intensive cotton farming. In procuring an early crop, aside from early planting, the most important features are in the selection of varieties and in fertilization. The tendency in the improvement of varieties of cotton in United States has hitherto been towards the production of those bearing long fibre. It is certain, in view of our present knowledge, that this tendency must be changed and strict attention given to earliness, which is naturally at the expense, to some extent, of length of fibre. There is, however, no necessity for cultivating varieties which have fibre so short as to interfere with commercial values.

"To quote again from the report of the Louisiana gentlemen who have been mentioned:

" 'On the black, stiff bottom lands we found in every instance, with but one exception, that the crop was a complete failure. Here the remarkable condition existed in the same field, exhibiting three-fourths of a bale per acre on sandy and mixed lands, while hundreds of acres of black stiff land yielded all the way from nothing to ten bales per hundred acres. Upon close investigation we found in every instance, the disaster was due to the fact that the cotton did not start to grow and mature until too late. The nature of the soil thus affeced is very cold and water sobbed. Many acres which were planted early had to be replanted. Others were too wet to be worked promptly; thereby early planting availing nothing, as the cotton stood still until too late. Under old conditions, these were the most valued lands. We found one exception to this disaster on stiff lands. An Italian had a piece of well drained and very well cultivated land. He made half a crop; viz, one-half bale to the acre—doing as well as if it had been sandy or mixed alluvial land.'

"This expresses one of the principal recommendations of the Bureau of Entomology, namely, that certain lands, which are universally known as slow, should, whenever possible, be devoted to other crops than cotton. In case the crop is held back by unfavorable climatic conditions on such land, it would in many instances be advisable for the planter to plow it up and replant the land with June corn or some other crop.

"The boll weevil hibernates most successfully in timber. Universally the earliest damage will be done along the edges of bayous and woods. Whenever possible, such situations should be devoted to other crops. At the same time the practice of clean farming, which does away with favorable hibernating quarters in grass, woods or hedge rows, should be encouraged."

On conclusion of Dr. Hunter's paper, he was asked by Mr. Glassell:

"What is the character of the Parker cotton—is it earlier?"

"The Parker cotton is earlier and has a larger boll than the King. The King has a longer lint, being from seven-eighths to an inch long. The Parker variety has a somewhat larger seed than the King. As demonstrated on our experiment farms in Texas, the percentage of the lint of the Parker is lower than that of the King, yielding only 28 or 29 per cent, while the King cotton goes as low as 31 per cent and frequently as high as 33 per cent.

"Cotton planted according to our system averaged half-bale per acre, while that planted according to the old system in many cases did not make a bale to a hundred acres. We have 1,500 acres divided into five different farm on which we made as high as a bale to the acre. The improved methods make from two to four times as much as the original or ordinary method."

"When do you burn your stalks?"

"As a general rule, by the 15th of October."

Hon. W. L. Foster, who has had considerable experience in cotton raising in Red River Bottom, and who has given the boll weevil question considerable study, delivered the following address:

"*Mr. Chairman and Gentlemen:*

"For years we have read and heard of the boll weevil, of his powers of destruction, of his freedom from attack by the insecticides commonly employed against similar plant enemies. Now we have him with us.

"I must say at the outset, that, though this subject might have been treated, from the standpoint of the Red River planter, by one more capable than I, it could not have been assigned to one more deeply interested, personally, financially, or from a patriotic love of country.

"As I said at the first convention on this subject, called at New Orleans, there are two extremes to which I hope our people will not go—(1) to become panic stricken, give up the fight, cry disaster, create fear and flight in capital, and thus more seriously cripple the industry than the occasion demands; (2) and much more important, is the need that they do not underestimate the danger, that they do not trust to luck that he danger may possibly be avered. He may be a craven and a coward who throws away his arms and flees at the first sight and sound of danger—but more to be pittied is the fool who eats, drinks and makes merry, despising the real danger, until the enemy has exploded a mine under him that destroys not only him, but many friends who depended on his knowledge of conditions to warn them of the real situation. To my mind the first thing to be learned by a man, and especially by one who would take public stand and make public utterances, on any subject, is that he does not live to himself alone—that no matter how humble be his station, how low the whispers of his convictions—there are some who will hear, will be convinced and will act and stake their welfare on his advice. Then how carefully should we conduct our investigations and how guardedly should we make known the results. He who would warn his fellowman of an enemy, whether human, insect or pestilent, and offer suggestions as to the means and manner of combatting the foe, would be a friend indeed; but he who would belittle the strength of his friends' adversary, and seek to inspire within him a sense of superiority and security, would indeed be worse than an open enemy.

"Now, is the boll weevil a dangerous menace to the South's great dependant crop—cotton? The testimony of thousands of our fellow farmers and planters in our sister State of Texas make plain the affirmative answer. Should their testimony be not sufficient proof, ask the merchant, the banker, the railroads, those never-failing indices of a country's or a State's or a Countys' prosperity.

"Is the danger temporary, or long-lived? Go ask the cotton raisers who, years ago, first encountered the dreadful pest, and you will be told that, of his own accord he leaves not the place where once he takes up his abode.

"Now, having given this hurried and incomplete reference to the danger accompanying the invasion of a section by this pest, the next question presented is: Are we with our fertile river valleys in any danger of an immediate invasion? The answer you, of course, know is that we are already invaded, that the Valley of the Red River is already infested at so many points that another year will find very probably no immune or uninfected localities, and we are now, right now, called upon to act, and act quickly, and all together. What that action should be is for this convention to decide. For my part I'll admit that I am awed and appalled by the enormity of the danger that threatens us. The Russians, manouevering their warships over the waters, beneath whose placid surface reposed the death-dealing mines of the Japanese, were never in greater danger of instant destruction than are the financial interests of some of us whose crops may be attacked and destroyed before we realize that the enemy is upon us, or learn how to combat him. Every thoughtful man must admit that the greatest danger threatens our river lands on account of the luxuriant growth of the plant, its long blooming and fruiting period and the natural humidity of the alluvial atmosphere.

"Right here I want to express my unwavering faith in the ability of our people to produce a specific cure *eventually* for this evil. A people who could overcome the obstacles and the trials and the troubles that the people of this Southland have overcome during the past half century, must force us to the conclusion that some one will yet come to the rescue with a specific remedy for this last and most insidious enemy.

"Just here let me digress long enough to refer to the work done, not only by the Federal Government, but by our State Government. The calling of the extra session of the Legislature; the appropriation of funds, and the subsequent putting in the fields of a corps of men, whose business it has been to watch and keep track of the invasion, as well as to study the habits of the weevil, was one of the most wisely important steps ever taken by an Executive of this State. Have they found a remedy, have they been able to repel the insect? No, but they have learned much of his habits, so that more is known today than ever before and they are able to tell it to us, and we are thus better enabled to form our ideas as to the best means of minimizing the severity of the coming attack.

"From the public and private utterances of those who have studied most closely the weevil, I have come to sum up its career as follows: When the weevil once infests a section it never quits it entirely; the first two seasons' appearance do not cause complete infestation, though its spread is extended through the seed cotton, gin and cotton seed and natural migration. From these means the third year's experience is total infestation by at least August 1st; this, however, will vary with the season and conditions. When the point is reached that total damage occures by August 1st, migration of the surplus may be expected. This migration may be many miles—ten, twenty, thirty or even more.

"The habit of the weevil is to pass the winter in the beetle or adult condition and emerge from winter quarters not at any stated time, but from March until June. Until the plants put on squares the weevils are unable to breed, but simply feed upon the terminal and tender leaves. When squars are produced a single egg is laid in each and in from fifteen to thirty or more days, depending upon the season, the egg has developed into a fully matured weevil, all within the square and hidden from view and out of the reach of poisons. The Spring increase is slow and hence the possibility of getting a crop in advance of the total infestation in August. We can not expect a top crop under the circumstances, and it is just here I wish to stress what appears to me to be the important point in the entire fight against the weevil. Weevils that have reached the beetle condition by *November 1st* seldom have sufficient vitality to reach the next Spring alive, but of the weevils that mature in cotton forms and bolls after this date a large per cent winter successfully and come out in the Spring ready for business. This being true, and we can in such matters, as in medicine, only believe what the doctors tell us—this being true, then the gist of the matter up to date seems to me to be in destroying the crop of last Fall laid eggs and larvæ. I was amazed on Douglas Island a few days ago to find on every blooming stalk examined some evidence of the weevil, and on the majority of them could be found the square with the tiny worm just hatched, and only one grown weevil did we find in the whole search. The only natural thing to do in such a case was to hurriedly pick the cotton, pile the stalks and burn up 99 per cent of the weevils that would hibernate there and be ready to come out next Spring *with the cotton* and absolutely destroy it. Another practical point worthy of note just here, is that not only does this burning destroy those eggs and larvæ already produced, but it absolutely prevents the production of any more in that field that season, as the weevil's eggs will not hatch unless she feeds on the cotton square.

"In this connection it is not amiss to call attention to the suggestion that acreage should be somewhat reduced, in order that cultivation may be more thorough, picking more rapid and finished sooner, and finally that this burning of the stalks may be accomplished. Now, this much being conceded, just what are the steps preliminary to the Fall campaign of burning and destruction? Plant as early as possible an early maturing cotton, several varieties of which have been successfully tried throughout the cotton belt during the past several years, and to some extent in our own sections during the past year. Having procured the early seed, the land should be gotten ready, laying off the rows east and west, so as to permit of as much sunshine as possible between the rows. When the land needs it, and will make proper returns for it, phosphate fertilizer should be used in order to further hasten the fruiting; then cultivation, especially by plowing, should be as rapid and often as possible, and I think just about chopping out time a good close application of Paris Green could be made with paying effect. On the stiff red land in our Valley I can not forbear to recommend the growing of alfalfa, if only to fertilize these lands, which will not respond to the use of any other form of fetilizers, leaving out of account entirely its value as a hay crop. The value of the early maturing cottons in the fight against the weevil is manifest, most prominent of which are (1) the major portion of the crop matures before the weevil has increased sufficiently to ruin it; (2) the crop being open early, picking can be done earlier and advantage taken of the fine weather we usually have in the early Fall; (3) the early cottons ceasing to bloom and furnish food for the weevil must militate largely against the hatching of the latter and more numerous broods; (4) the crop being gathered early, allows the stalks to be burned.

"Should the weevil appear at all, the foregoing shall be my plan of campaign, until a seemingly better one is pointed out.

"In conclusion, I would urge upon this convention to pass resolutions endorsing the work of our Crop Pest Commission, and calling upon the Legislature to appropriate a liberal fund, in order that the work so well begun may be continued, and not only in the cotton fields, but in the gardens, the orchards of our people, where today they are being robbed, without their full knowledge, of millions of dollars by insect ravages."

Mr. August Mayer, of Caddo, asks:

"What effect has the fertilizing had upon your crop—how much sooner did it mature than the cotton planted without any fertilizer?"

"I can not answer that question, for the reason the marks we put on the cotton were destroyed in plowing, and we, therefore, had no means of telling which cotton had been fertilized. We fertilized for the purpose of increasing the fruiting more than anything else. What the result was, I do not know."

Mr. August Mayer, a prominent planter of Red River, delivered the following helpful address:

"*Mr. Chairman and Gentlemen of the Convention:*

"The first thought that presents itself to any man whose old-time chance for making a living is about to be curtailed or destroyed, is: What else can I do to make ends meet? The planters of Red River Valley have heretofore been able to enjoy life without very much mental exertion. Our lands always furnished, even him who farmed it in the most slip-shod manner, a fair living. The laziest 'nigger' with a half-dead mule and a thing looking a little like a plow, all hitched together, scratching the ground enough to make a mulch all the way from one-quarter of an inch to one inch deep, would produce several bales of the most beautiful cotton, dearly beloved by all of us, and rightly so, and thereby keep his little pot a boiling, and master's also. This idyllic life, alas, has received a sudden jar. Warning has come to us that even the Red River planter has to reform and become a farmer, because the little, tiny wee-billed (weevil) called the Mexican cotton boll weevil, is spreading into our fields, and threatens to make cotton come a little too high for the producer.

"Now, our agricultural authorities, State and National, have long endeavored to impress upon the farmers of the South that it was an unwise policy to depend upon only one crop; that we should supplement our main crop with others, so that a total failure of the harvest was, if not impossible, at any rate improbable. These authorities have maintained, and have been fully borne out by old country exepriences, and even our own, if we will only admit it, that to maintain the fertility of the soil, and therefore preserve its ability to give us paying crops year after year, we must practice rotation, and that with this practice, we should combine the raising and feeding of live stock. Can the Red River planter follow this advice and profit thereby? I believe very few of us have not experienced the wondrful increase in the yield of cotton when the land has been given a rest by growing a crop of cow peas. Or have not many of us seen that after we have had a field in alfalfa for a few years it would yield simply wonderful crops of cotton or corn? Even letting your land lie idle a year or two, trampled down and grazed over by stock, will regenerate it wonderfully, and pay us beautifully for the rest we granted it. Rotating crops, however, does not only rest the soil from its labors of furnishing the same ingredients to plant life, but it also distracts the insect enemies of the crops by covering the old-time haunts and places of habitation with, to them, a strange plant, furnishing them no food at a time when they need it badly, and thus causing many to perish. Rotation of crops is no help to the boll weevil.

"I have said that our agricultural authorities agree that no land can maintain its fertility without help from the farmer. They have pointed out that the most rational way of giving back to the land what we have taken from it is through the manure from the animals raised and fed on the farm. It is a wonderful fact that after the animal has assimilated from its food what is necessary to build up its body, its excrements contain nearly all the fertilizer ingredients originally possessed by the food eaten. In other words, if we send the products of the soil through the economy of the animal, we return through its manure to the soil nearly the same plant food that we would have had if we had turned the entire crop under, and we have the animal, developed by this food, besides. It is the farm animal which makes the soil yield today a living to its inhabitants which was tilled in the time of Cæsar, while lands cultivated in our own country for less than a hundred years, with no fertilization, have been abandoned as barren.

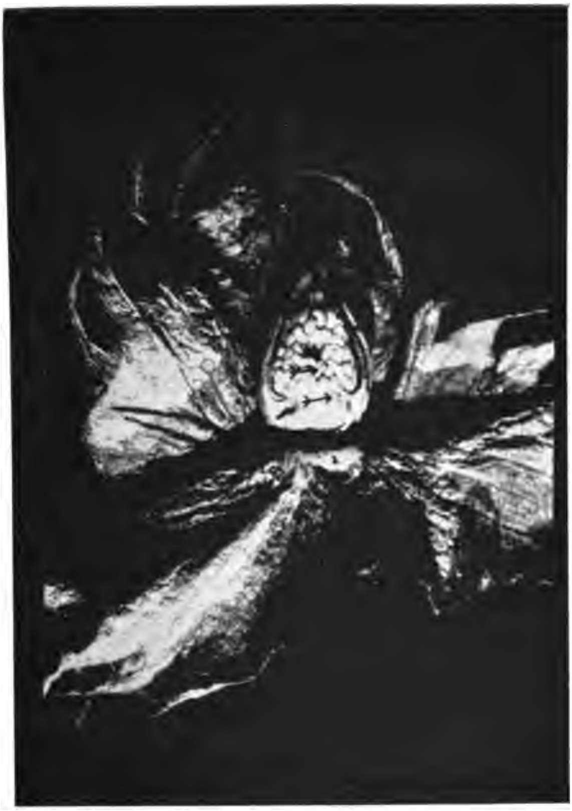
"Some of the Red River planters have turned their eyes upon the industry which has made the great Middle States what they are today. The cattle of the farmers of Iowa, Indiana, Illinois, Wisconsin, Minnesota and the Dakotas and still other States have made them money lenders—not borrowers. Can we turn tables in the same way, by following their examples? I say *Yes* and *No*. Yes, if we spend our time and energy only with good cattle, for which there is an unlimited market, and accord them proper treatment; cultivate them, so to speak, as we would cultivate a thrifty, well paying crop. *No, under all other conditions and circumstances,* and a very big and most emphatic NO if you do not study and get the best of another insect, not to come in the near future, but already safely installed all over the South and even other States. I refer to the cattle tick, *boophilus annulatus,* transmitting what is known as "Texas fever" to all bovine creatures, imported or native born. I speak from dearly bought and paid for experience when *I say that a profitable cattle industry with the fever tick rampant is a thing as much impossible as it is to raise a crop of cotton with the boll weevil rampant.*

"This would promise a gloomy outlook for the industry here which has done so much for many States, and for which the South, including Louisiana, seems particularly suited, had not great good fortune placed the means in our hands to beat this enemy of the farmer on all sides. And I am proud to proclaim the fact that this knowledge has come to us from our own experiment station at Baton Rouge, in the nick of time, partly yet unpublished. Our great and good friend, Professor Morgan, has worked on this problem for many years, and an experiment on a moderately large scale just concluded at my own farm, under the instructions and with the kindly help of Professor Morgan, has completely verified his conclusions. We can eradicate the tick quite easily if we will; we can raise cattle, tick free, if we will, and tick free we must raise them if they are to help us on to prosperity. I can not go into detail here and bring out the scientific part of this luckily timed investigation—that belongs to a bulletin which I hope our National Department of Agriculture will bring out for the benefit of all tick-infested territory. The investigations conducted by Professor Morgan, and the results thereof, are of the greatest importance to the entire country. At present there is placed upon one-half of the United States an embargo against unrestricted trade in cattle on account of the existence of this tick. This restriction placed upon this industry when practically nothing was known of the life, history and habits of this pest militates greatly against a healthy, profitable trade in one of the greatest commodities of commerce. Now, the investigations of our experiment station and my own under the direction of Professor Morgan have conclusively proven that the dangerous tick can be eradicated from our pastures, and that we are in position to market clean cattle, can ship them to any section of the United States at all seasons of the year. I believe the time is coming when this question of ridding our country of the cattle tick will be taken up by the National Government and will be solved to everybody's satisfaction and benefit. I think, however, in order to hasten the day when this happy state of affairs comes about, the farmers of the South and North, through their various organizations, especially the cattle breeders of the country, should call upon our National Secretary of Agriculture and request him to look into this matter at once. The Bureau of Entomology could carry on experiments on a large scale, based upon the findings of our own stations' investigations, just as the Bureau now carries on experiments with the boll weevil, the cattle tick problem being in its importance only second to the problem we are called upon today to discuss. State laws and parish regulations, with a view to eradicate the tick from the State, or even smaller territories, could be passed, whereupon the embargo placed upon unrestricted trade in cattle might quite properly be raised for the tick free territory, of course subject to precautionary regulations made by the Secretary of Agriculture. Suppose the State of Louisiana were to eradicate the deadly tick from her territory, why should not the Secretary of Agriculture raise the embargo against the State of Louisiana, under suitable regulations? Why not raise it, for instance, from the northern part of the State, if it were tick free; or from the Parish of Caddo, if we had no tick infested pastures? If a single parish, through the aid of the authorities, had secured unrestricted trade in cattle with the territory above the quarantine line, it would be but a short time when others would fall in line, and thus the day would be greatly hastened when all the States would enjoy free trade with each other in the great cattle industry.

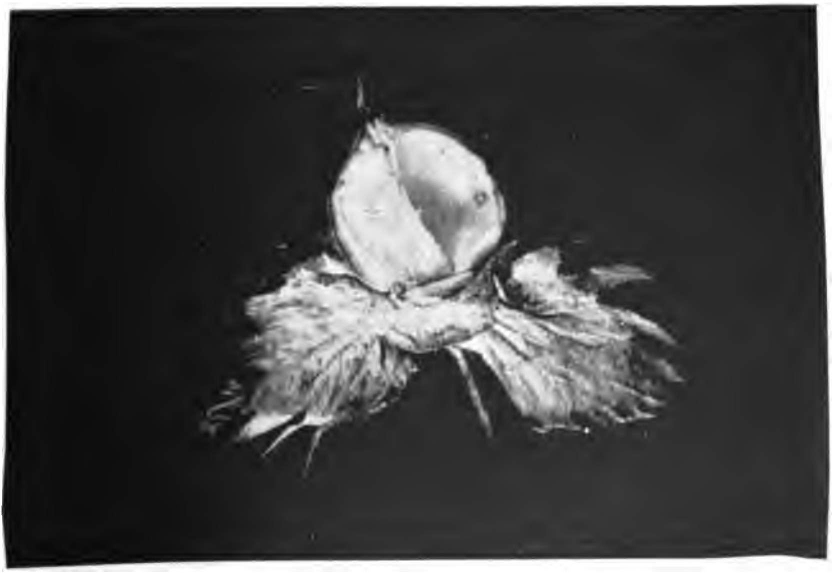
"This problem is of such vast importance to the Red River farmers, the State of Louisiana, the entire South, and indeed to the whole United States, that I think this assembly should not lose the opportunity to take the preliminary steps to have our Crop Pest Commission, to whose province this matter very properly belongs, instructed to probe into the matter at once, and also request the United States Secretary of Agriculture to start a thorough and comprehensive investigation, with the object in view outlined above.

"To show what can be accomplished, I will shortly state the principal features of the exepriment conducted on my farm, based upon the life history of the cattle tick, as determined by our station entomologist: Early this Spring I put about fifty head of registered Shorthorn cattle, better known here as Durhams, into a Bermuda pasture. They were all in very good condition, and by the first of July were simply beautiful to behold—slick-coated and fat as could be. But now the tick had time to multiply and a second brood had hatched, and what was one solitary, old female tick in April was now represented by several millions of its descendants; and in about another thirty days of summer weather these pests had done *their* work at multiplying, producing such a number of ticks that my arithmetic gives out at pronouncing the result! But my eyes were saddened to note their destruction. Those beautiful cattle lost flesh in the finest pasture of Bermuda and other grasses. Their glossy coats went away, and in a few weeks all had fallen off several hundred pounds each. I tried several kinds of washes, highly recommended by the manufacturers; I made some myself after standard formulas. We washed the cattle for a time every week or ten days, and while the emulsions did some good, they were only make-shifts. It is true we killed many ticks—but as many remained alive on the animal, and even if we had killed all of them, there were countless billions waiting for their victims in the pasture. In this way the cattle remain infected, and it became apparent to me that if they were not soon freed from these blood destroying pests they would die from starvation with the grass up to their knees. Indeed, I had to feed a number of the beasts to keep the poor things on their feet.

"Upon Professor Morgan's advice I took the cattle out of the pasture September 7, and put them up in a cow lot, large and shady, which had had no stock of any kind in it since April, and therefore all ticks living in this lot had died from starvation by the date mentioned, as a seed-tick can only live in midsummer two months without food, *i. e.,* blood from an animal, while in the winter months they endure starvation for a great deal longer period, about six months. The cattle were fed here and kept in this lot twenty days. Then we took them out and put them in another cow lot, separated from the former by a double fence, ten feet apart, and in which lot, also, no stock had been since April, and after twenty-two days' confinement in this lot, the cattle were completely free from the millions of ticks which the animals carried when put into the first lot, save a limited number of male ticks, which were, of course, harmless, as they could not reproduce their kind and would soon die a lonely death. The cattle, being now clean, were put into a tick-free lot, No. 3, and into a corn field which is tick free. The cows have recuperated and are once more happy, and when I put them again in the aforementioned pastures, it will be on a date when I am certain



Two Eggs and Feeding Excavations in a Square.



Egg Deposited in Half Grown Boll—On Inner Side of Carpel.

that all the countless billions of ticks now waiting there for a meal will have died of starvation, about May 1, 1905. Then, when I put my clean cattle into a clean pasture, neither I nor the cattle will have to undergo the tortues of the past summer and sustain such losses which must make their raising a profitless employment.

"Without these ticks, I may assure you we can raise cattle in Louisiana that are a pleasure to behold, and will help our pocketbooks endure new conditions brought about by the boll weevil. Indeed, with a few real good cows back of us, we can starve the boll weevil to death, since, if need be, we could abandon cotton for a few years, depending largely on Old Bess for a living."

Secretary Giles read a letter from D. A. Templeton, of Dallas, who was to have delivered an address on the boll weevil situation from a banker's standpoint, stating that he could not be present, but hoped to attend the convention the following day.

Mr. George H. Tucker, manager of the Virginia-Carolina Chemical Company, of Memphis, read the following paper, urging the use of fertilizers. He said:

"'THE INFLUENCES OF COMMERCIAL FERTILIZER ON THE EARLY MATURING OF COTTON.'

"This is the subject assigned me by the Crop Pest Commission of Louisiana. Were I to confine myself to this subject my words would be few, for whilst we know that it is a fact, admitted by the best informed, that commercial fertilizers do influence the early maturing of cotton, still it is difficult to elaborate in an interesting manner upon direct causes. I should have preferred as a subject, 'Commercial Fertilizers, Their Influences Upon and Relationship with Modern Cultural Methods,' and I shall endeavor to treat the subject upon a somewhat broader scope. I therefore hope in submitting this paper I may be pardoned if I digress from the main subject occasionally in the hope and with the view of bringing about a better and more perfect understanding between the manufacturer and consumers of commercial fertilizers. I undertake to say that the modern methods now employed in farming have rendered inseparable these intrests;

therefore, we are not out of place in considring with you farmers the great question of crop pests and possible remedies. Your success means our success. That which harmfully operates upon your pursuit tends to seriously jeopardize, if not destroy, our industry. Self interest, oftentimes the main spring of action, and not philanthropy, therefore, prompts the honest manufacturer (who has hundreds of thousands of dollars invested in expensive factories which can not be taken away or removed) to not only supply you with honestly made fertilizers, but to use his best efforts in instructing you what valuable elements of fertilization are best suited to your purposes and how and when these fertilizers should be applied.

"The ancients held that land could not be planted year after year and yield satisfactory crops, and the Mosaic law, given to the children of Israel, had for its object, amongst other things, the resting of the land every seventh year. How many of you farmers do this? You know that each crop harvested tends to impoverish the soil by taking away valuable elements. Commercial fertilizers have made this resting of the soil unnecessary and now land is planted year after year and yields larger crops successively, because the soil is improved by modern methods of cultivation, fertilization and rotation of crops. This question of land improvement is one of vital interest to the farmers. Proper drainage is one of the most essential features of proper cultivation. Deep, broadcast plowing assists drainage materially; indeed, it is quite necessary. On rolling or hilly land the utmost care should be exercised in plowing, with the view of preventing running water, which not only tends to break up the land, but to carry away fertilizing properties. On the other hand, where land is plowed deep the water readily soaks in, carrying in its downward course the valuable elements of fertilization. All surplus vegetable matter should be plowed into the land. This vegetable matter decaying provides some fertilizing properties, especially nitrogen, though only in small quantities. It also tends to produce humus in the soil.

"Upon an examination of soils and the ashes of plants, their fruits and seeds by chemical analysis, it was found that the substances contained in the soil were, for the most part, reproduced in the plant. The most important of these are phosphorus, lime, magnesia, silica, nitrogen, potash, iron, sulphur, carbon and oxygen. These, then, presented a basis and source of information upon which the agricultural chemist could work with the view of supplying plant life with the necessary elements of nourishment. Experiments in actual plant culture were made and of these elements three were found to be of the most importance, namely: Phosphorus, nitrogen and potash. Phosphoric acid is formed by the action of nitric acid upon phosphorus. Nitrogen is sometimes commercially called ammonia. This is not technically correct. Ammonia consists of fourteen parts of nitrogen to three parts of hydrogen. Ammonia is readily soluble in cold water; nitrogen is not. Potash appears in several combinations. This is also true of phosphorus or phosphoric acid. The most valuable agricultural form of the latter, however, is in combination with lime, spoken of generally as bone phosphate of lime. Of the other elements named almost all soils contain an abundant supply, and it is quite impossible to ascertain just what office they perform in vegetable economy. Of the three most important elements—phosphoric acid, nitrogen and potash—the soil becomes exhausted and each crop harvested tends to this exhaustion. Unless these elements are restored, the soil becomes worn out and unproductive. As illustrating this, in the case of phosphoric acid, about the end of the eighteenth century it was found that the fine red sandstone land of Chelshire, in England, became comparatively sterile, which was entirely due to the deficiency of phosphoric acid consequent upon the growing of the same crops year after year with no effort to restore to the land this valuable element taken away. This was before the use of acidulated rock. The fertility of this land, which was pasture land, was entirely restored and its value doubled by repeated dressing of common ground calcine bone. The phosphoric acid in acid phosphate is much more available and more quickly assimilable than in animal bone. It is also, commercially speaking, very much cheaper. Phosphoric acid enters into the structure of every plant and animal. It is a substance that can not be dispensed with in either animal or vegetable economy. When it is sparingly diffused in the soil, it must be introduced artificially and commercial fertilizers present the very best and cheapest method of accomplishing this.

"You can not make something out of nothing! That is not Nature's plan, as is evidenced by the germ of the seed, whether of animal or vegetable life. This seed must grow and fatten and put on size and strength. To accomplish this it must absorb or assimilate and take in other properties, and just how this is done is one of the mysteries of life. Holy Writ sets forth, in reference to this question. 'And that which thou sowest, thou sowest not that body that shall be.' Further explanation, however, seems to have been denied us, and we know not how the seed changes into roots and leaves that afterward develop the plant-body. We do know that this seed forms another body and this body must have nourishment suitable for its structure. Nature provides her potent agents of light, heat, moisture and air and without these no animal or vegetable life can survive. Animal life requires food of breadstuffs, flesh and vegetables; hence we work to supply these elements of nourishment in furtherance of Nature's laws of conservation and reproduction. So vegetable life requires phosphoric acid, nitrogen and potash, and if these elements are not in the soil, they must be supplied; and if they were there, but have become exhausted, they must be put back in perpetuation of God's law that 'every seed must bear fruit after its own kind.' We are told that 'forms decaying, other forms supply.' Hence the bodies of animals, in the process of change under natural laws, contain food for plants; the bones being rich in bone phosphate of lime, which is another form of phosphoric acid, and the flesh and blood contain nitrogen. So, too, plant life largely furnishes food for animals and each of these in turn supplies food in one form or another suitable to each other. Decayed vegetable matter produces nitrogen and the ash of hard woods is a fruitful source of potash. The rains, frosts and the sun disintegrate rocks from which potash and phosphoric acid are produced, and the nitre beds of Chili in South America furnish thousands of tons of mineral ammoniates known as nitrate of soda.

"It may be interesting for you to know that there are three sources of commercial nitrogen. They are animal, vegetable and mineral. Hence the importance of turning into your land stable or barnyard manure, trash and other vegetable substances.

"It is quite impossible for the manufacturer to tell you just what your land needs. He can help you to determine this. Many farmers seek to have their soil analyzed with the view of determining a suitable fertilizer. I say frankly that these analyses are oftentimes misleading and deceptive, for the reason that Nature has not told us all of her secrets, and her plan seems to have for its object perpetuation, thus reserving a portion of her store of bounty for future crops and future generations. So it is that frequently insoluble elements of plant food are found in soils. These are not available, which means they are not prepared for the use of the plant and are not in assimilable form. Chemical analysis will frequently show phosphoric acid, potash and even nitrogen in the soil. The elements, however, which tend to make these properties available are sometimes not present, and therefore they are not suited for plant nourishment. I can best illustrate this by an example: Phosphate rock, which is mined in South Carolina, Florida and Tennessee, is rich in phosphoric acid, or, more properly perhaps, bone phosphate of lime; but this is not in an assimilable or available form. I undertake to say that a lump of phosphate rock carrying 80 per cent of bone phosphate of lime can be put under a plant and it will not give off an atom of plant food. If this rock is ground to an impalpable powder, the acid secreted by the root of the plant coming in contact with these molecules will dissolve some of them, rendering the phosphoric acid, to a limited extent, available. The action of the soil, too, will tend to dissolve some of this bone phosphate of lime which, from year to year, will become soluble in the land, tending to its permanent improvement. The fertilizer manufacturer just here assists nature by decomposing the bone phosphate of lime in the rock, causing it to become immediately available as plant food by reason of its solubility in water or the acids in the soil. To do this the rock is thoroughly cleansed of all foreign substance, is finely ground and treated with sulphuric acid. This process tends to cooking or decomposing the rock; the product, then, is known as acid phosphate and is the most fruitful source of available phosphoric acid known to the trade. Nature, in her greatest of chemical laboratories, is, year by year, bringing some of these insoluble elements into condition of availability, but her process is slow and she will not he hurried. This you discover by laying out your land one or two years after a series of crop growings. It will, when planted again, produce better results. All of you know this. The very best analyst of your soil is your cotton plant itself. Watch this and it will tell you what it needs. If it grows very large, putting on abundant and vigorous foliage, and is backward in maturing, growing vigorously late into the Fall, you know the soil has sufficient or even an excess of nitrogen in proportion to other elements of plant food. Now, you watch this plant and you will find that it does not fruit as abundantly as its size and vigor would lead you to expect. Why is this so? you ask. My answer is, emphatically, not enough phosphoric acid in relationship with the nitrogen present in the soil. You know then that the soil needs phosphoric acid or phosphoric acid and potash. The application of from two to four hundred pounds of these materials per acre will cause the plant to put on fruit in relation to its size and vigor and will, furthermore, cause it to mature its fruit from two to three weeks earlier. On the other hand, if your soil produces only a small, sickly plant, even though it fruits well, in addition to the phosphoric acid or phosphoric acid and potash, you need nitrogen to give the plant vigor of growth and foliage. Nitrogen, or ammonia, will cause it to put on larger stalk and more luxuriant foliage. Potash is very essential in most land, especially when the land is subject to rust or blight, and it is also quite beneficial where the land suffers from drought. It tends to keep the plant green and succulent. Usually heavy clay lands are well supplied with this element, but light and sandy lands are deficient and will respond freely to a proper application of this valuable element of plant food. Agricultural chemistry would seem to assign to nitrogen the office of producing vigorous growth. New land, river or creek bottom land, contains decayed vegetable matter which produces nitrogen; hence the dense foliage and undergrowth observed on such lands. Nitrogen applied to plants at the early blooming stage will cause such plants to stop blooming and put on larger growth, thus retarding the fruiting and maturing process. It assigns to phosphoric acid the office of checking the too rank growth of stalk and foliage and of forcing the plant in season to put on fruit and to mature early. Phosphoric acid enters largely into the composition of seeds and is most essential to a crop whose fruit is in its seeds or in the fibre in which the seed is nourished and matured. It assigns to potash the office of enlarging the roots and leaves, building up the fibre of the stem and the bolls; it also keeps the plant green and promotes growth, especially protecting it against blight and rust.

"Experiments in the chemical laboratory and farm tests all prove what I have said with regard to commercial fertilizers forcing crops to earlier maturity. I can not explain to you why this is so. You know if you shut up a hog in a pen and give her all she can eat she will soon be very large and fat. Well, if you give your crops all they can eat they, too, will soon grow very large and perform the functions assigned by Nature's laws.

"In making this statement as a fertilizer manufacturer you may assign to me self-interest as a motive. I, therefore, shall try to give you other proof than my simple assertions. First, we will take the testimony of those splendid workers of the United States Department of Agriculture. I quote from Prof. W. D. Hunter's interesting treatise on the boll weevil, published in the Farmers' Bulletin, No. 189, page 8, issued by the Department of Agriculture at Washington:

" 'It is known that at present fertilizers are not used to any considerable extent in cotton producing in Texas. There is, nevertheless, no doubt that they should be; not that the land is poor, but that earlier crops may be procured. At present it is sufficient to call attention to the fact that it has been the uniform experience of experiment stations and planters in the eastern part of the belt that certain fertilizers, especially those involving a large percentage of phosphoric acid, have a strong tendency towards hastening the maturity of the plants.'

"You all, of course, know that Professor Hunter is in charge of the cotton boll weevil investigations of the Department of Agriculture of the United States. In pursuing this question Professor Hunter declares that: 'The important changes that have been brought about up to this time in the use of improved seed and fertilizers, have also been revolutionary in their character.'

"I should like to recount for your information a conversation had with one of the most thoughtful and progressive planters of Upper Mississippi. During the Spring of 1903 Mr. F. L. Wright, of Horn Lake, Miss., said to me in person that in the Fall of 1902 he had forty acres of the best cotton he had ever seen. Pointing to a door which is six and one-half feet high, he said the plant was as high as that door and that he and his neighbors estimated a yield of at least a bale and a quarter per acre. He suggested that I guess what the actual harvest was. I, of course, had no idea and so stated. To my great surprise he said it was less than four bales. I was greatly astonished at this, as you may imagine, and asked the reasons. He said that the cotton was grown on very rich second bottom land; that it did not fruit well and was growing green and succulent late into the Fall, when the frost came and killed it. The crop indications herein shown convinced me that this land had an abundance of nitrogen, but that the phosphoric acid was disproportionate to that element of plant food; I, therefore, very promptly stated to him that in my judgment had he used 200 pounds of our acid phosphate alone per acre on the land planted it would have yielded the fifty bales expected, and I asked him to make the test the ensuing season, offering, in case he was not willing to buy the fertilizer, to give him enough to experiment with. We discussed this question in all its bearings and more at length than our time at present will permit of my relating. However, during the Spring of 1903 Mr. Wright was again in our office with the purpose of buying some complete fertilizer for his corn; at the same time he bought 1,000 pounds of Royal Acid Phosphate. I heard nothing further from Mr. Wright until I wrote him the following September, asking him of he had used the acid phosphate on the cotton land indicated, and if so, would he kindly give me the results. A short time after this Mr. Wright came to our office, bringing with him a splendidly developed stalk of cotton, well fruited, and expressed his great satisfaction with the result of his experiment. After this he wrote us a letter, giving the details, which are as follows: By reason of the cold, late Spring, he said, the cotton was replanted on May 11th; it had only two rains during the season, May 29th and August 29th. At the time he wrote, he said this cotton was farther advanced than cotton alongside of it, planted thirty days earlier, upon which no fertilizer had been used, and he stated further that this cotton was fruited to the top and that he would make a bale to the acre, whereas his cotton not so fertilized was almost a failure. He added that he would not hesitate to recommend acid phosphate most highly on similar land.

"The following article, copied from the *Bryan Eagle,* Bryan, Brazos County, Tex., of Thursday, July 21st, 1904, can not, I think, fail to be of interest to you, hence I give you the article verbatim:

" 'COTTON EXPERIMENTS AT COLLEGE.

" 'Variety and Fertilizer Test—Something Brazos County Farmers Might Well Go to See.

" 'An *Eagle* reporter, in company with a party from Bryan, looked over a part of the Agricultural and Mechanical College experimental farm last Thursday. The visit was upon the invitation of President D. F. Houston, and Dr. Houston, Prof. R. L. Bennett, the cotton specialist at the College, and Professor Marshall accompanied the party and pointed out the matters of interest. The party of visitors were: Prof. T. S. Minter, Dr. J. L. Fountain, Edgar Covey, J. A. Meyers, W. Wipprecht, J. H. Perrin, E. J. Fountain, S. M. Winters and W. P. Connelly. The primary object of the visit was to see the work of Cotton Specialist Bennett, in charge of the joint cotton work of the Bureau of Plant Industry and the Agricultural and Mechanical College.

" 'The work, as stated by Professor Bennett, is directed, first, to the ascertainment and development of varieties for early and rapid fruiting; and, second, to demonstrate the advantages of proper feeding, or fertilizing, to effect the same results. Forty or more standard cottons, early, medium and late in fruiting and maturity, are grown for one experiment. These various cottons were planted and fertilized alike and cultivated five times since chopping. The results show marked differences between the different varieties in quantity of fruit contained at the present time. The earlier kinds have practically the same amount of stalk growth as the later cottons, but have from one and a half to three times as many bolls and squares as some of the later cottons. On the early varieties, the prospects now are good for a bale to the acre, notwithstanding considerable damage from the boll weevil, and barring greater ravages than are now anticipated. This yield is on the very poor upland that constitutes a part of the College property.

" 'The second object of the experiments, as already stated, is a study of fertilization, to effect early and rapid fruiting. Professor Bennett says the question of feeding or fertilizing cotton is a new one to the Texas cotton grower, but the coming of the boll weevil has limited the fruiting season, and it has become necessary to force the cotton plant to make and mature as much fruit as possible within a limited time. He says this can not be done without feeding the plant; that this feeding or fertilizing must be done with a view to the ascertained needs of the soil. On the College cotton land the ordinary yield has been less than one-third bale to the acre, before the appearance of the boll weevil. Since the weevil has come, as indicated by results last year, the yield has been still less. This low yield indicated the need of plant food.

" 'He has applied fertilizers, and the results already apparent are marvelous. On rows where a complete fertilizer was applied, one familiar with cotton can see that a bale per acre is in sight. More rapid increase of the boll weevil than is to be reasonably expected within the next two weeks may reduce this estimated yield, but not reduce it below one-half bale per acre.

Had it been possible for Mr. Bennett to plant this cotton about the 20th of March, when most of the cotton in this section was planted, a bale per acre would now be safe in grown bolls.

" 'Adjacent to the plots of fertilized cotton is a tract of three acres, planted March 19th—with three early varieties of cotton—twenty-one days earlier than Mr. Bennett's fertilized plots; but in size of stalk and quantity of fruit, it is at least twenty days later than his fertilized cotton. In fact, but few of the squares on it have bloomed, and there are but few mature bolls, while the other has now a good setting of safely matured bolls.

" 'The cost of the fertilizer, where the large yield noted is in prospect, does not exceed $3.50 per acre. Professor Bennett infers from these experiments, and others he has on Brazos bottom lands, that the so-called poor uplands, in the vicinity of the College, properly fertilized and planted with pure-bred seed of early varieties, will rank right along with the famous Brazos bottoms in the matter of yield per acre—also, that by proper feeding of early cottons with fertilizers an early maturing of a large yield can be made annually in any cotton-growing section of the State.'

"Perhaps there is no section of Texas where the depredations of the boll weevil are greater than in this Brazos country.

"I quote in full a clipping from a newspaper published in Paris, Tex., which was sent us by parties in Paris who had used our fertilizers, this being the first experiment with commercial fertilizers in almost the northern limits of Texas:

" 'CROP IMPROVED BY FERTILIZERS.

" 'Experiments Tried This Season Led to Good Results.

" 'Messrs. T. J. Record and Worth Duncan drove out in the country a few miles east of the city yesterday to take a look at the growing cotton crops and to visit some fields in which fertilizers were used in an experimental way this season.

" 'In one field where the land is considered rather poor they counted the bolls and squares of twenty-five stalks, each, of the fertilized and unfertilized ground. Of the former there were 433, against 180 for the latter. The quality of the land was identically the same for both, and the seed and date of planting were the same. Not only was the fruiting of the fertilized land much the greater, but the bolls were larger and farther advanced.

" 'The gentlemen were quite favorably impressed with the outlook of the cotton crop generally and report very fair prospects. They say there are some boll worms at work, but don't think they have materially damaged the cotton yet.'

"It would take up too much of your time to pursue this part of our subject longer. We have numerous testimonials which not only set forth the increased yield from the use of commercial fertilizers, but the earlier maturity of the crop. These come to us from Mississippi, Louisiana, Arkansas and Texas.

"Perhaps no word of mine or even the experience of others will convince you. I therefore suggest, as it will not cost much money to experiment, that you do this. It will only be necessary for you to use a complete fertilizer on one acre, phosphoric acid and potash on another acre, phospohric acid alone on the third acre, and leave the fourth acre unfertilized. Keep a diary during the season of each of these acres. At the end of the season harvest each separately. You will find that on each fertilized acre the yield will be larger. Then it becomes a question of the cost of the fertilizer with relationship to the additional crop produced. You can determine for yourself in this way whether it is in the line of your advantage to use fertilizers and which fertilizer is best adapted to the peculiarities of your own soil.

"There has been a persistent effort on the part of some manufacturers to argue the use of complete fertilizers, and by complete fertilizers we mean those which contain the three valuable elements of plant food, namely, available phosphoric acid, nitrogen (or ammonia) and potash. If you are in doubt, I say by all means use the complete fertilizer and, in the majority of cases, it will pay you best. Still in many parts of Texas and also in Louisiana the land is very rich and produces large, vigorous growth of stalk and foliage. Upon such land I do not recommend more nitrogen (or ammonia). In such cases acid phosphate alone, containing only available phosphoric acid, or acid phosphate and potash, containing available phosphoric acid and potash, will be sufficient. On this character of land you want to force abundant fruiting and early maturity. It is just here, then, that the phosphoric acid gets in its good work and is essentially what you need.

"The entomologist tells us that the boll weevil thrives best in vigorous cotton, as it seems to prefer the shade of the leaves and does not like the heat of the sun. Nitrogen (or ammonia), as heretofore explained, will produce more vigorous growth of leaf, thereby, so to speak, encouraging the boll weevil. So, unless your plants are small and foliage light, do not use ammonia, but use acid phosphate or acid phosphate and potash. Two to four hundred pounds per acre on rich land. Acid phosphate will not materially increase the size of the plants, but it will cause any size plant to put on more fruit and to ripen its fruit in season. I undertake to say that the use of phosphoric acid in the cotton field has saved to the agriculturalists of the South thousands of bales of cotton from frosts. The older of you must see how much sooner cotton is harvested now than it was twenty years ago, when the September picking was practically ignored in counting the cotton crop. Another advantage to be gained by the use of acid phosphate is that this material frequently shows also a potash effect on crops because it renders, by its action, some of the insoluble potash in the soil available as plant food.

"A letter just received from Mr. Joseph Ramage, Keck, Tex., who has been making some experiments for a German potash syndicate, may be of interest. He shows he experimented on three plots; the first with potash alone and the yield was as four and a quarter; on plot No. 2 the experiment was with phosphoric acid and nitrogen, where the yield was as eleven and one-half; on plot No. 3 the experiment was made with phosphoric acid, nitrogen and potash, and the yield was as sixteen. These experiments show, as we would have supposed, that the three elements produce the best results. They would have been more interesting had Mr. Ramage stated the relative quantities of each element used in his mixtures and character of land upon which the experiments were made.

"To produce the best results the three elements of plant fertilization should be present in certain relative quantities and it might be stated just here that various crops require different percentages of each of these ingredients. Sometimes the land will contain an abundance of one or more and be deficient in the other. All this can only be determined by experiment and crop indications. A plant can only produce the best results when conditions are favorable and the elements of plant food are present in sufficient quantities.

"Quite an erroneous impression seems to prevail in some sections where commercial fertilizers are not known that the land is injured by their use. The judicious use of commercial fertilizers unquestionably improves your land, from the point of view that commercial fertilizers are not plant stimulants, but plant food, and tend to the upbuilding of your lands, enabling you to plant them successively year after year.

"I fear I have already taken up too much of your time, perhaps exhausted your patience; still in entering upon this subject I asked that you would pardon a digression where my aim was to bring about a more perfect understanding between the farmers and the fertilizer manufacturer.

"I want to tell you that we are not all of us dishonest, as the drastic fertilizer laws of some of the States may lead you to suppose. We heartily approve of equitable laws having for their object your and our protection, but these laws should be drawn impartially with the view of protecting the farmer and not imposing unnecessary hardships upon the manufacturer. Everything that adds to the cost of an article or the risk of collecting for the same, in like relationship enhances the selling price, and the consumer pays both. Oftentimes legislators, for political effect, having no knowledge of chemistry or the subject sought to be legislated upon, attempt restrictive and burdensome statutes which simply serve to cloud the points at issue and are promotive of no good ends. Your safeguard is in dealing with people whom you know to be honest and reliable and whose established brands and trade marks are of more value than the few dollars of profit that would result from imposing upon you. Your Commissioners of Agriculture and State Chemists are faithful workers in your interests and much of their work can be relied upon; still, like others, they may sometimes be led into honest errors, especially in the laboratory. With the best intentions it is sometimes absolutely impossible for the manufacturer to so thoroughly incorporate into a fertilizer each ingredient so that the smallest sample may show the exact relative proportion. It may interest you to know that the part of a sample which undergoes treatment by the chemist is about as much as can be held upon a five-cent piece. Do any of you think he can so thoroughly mix sixteen hundred pounds of corn meal, two hundred pounds of sand and two hundred pounds of sugar so that each teaspoonful of the two thousand pounds would show exactly 80 per cent of meal, 10 per cent of sand and 10 per cent of sugar? Or, suppose you mix as thoroughly as you can one-third of a quart each of white peas, cow peas and speckled peas, will any of you undertake to say that, counting the peas in a gill cup, there will be found the exact number of peas of each color, say one-third each? Likewise, because the analyses of a fertilizer vary slightly there is no evidence of deception. I undertake to say there is quite as much adulteration in foodstuffs for man and beast as in commercial fertilizers. It is said in criminal cases the lawyer's mistakes are sometimes six feet above ground, the doctor's six feet below. You feed your cattle, or your family for that matter, on adulterated food and you do not know it. You feed your crop on adulterated, worthless fertilizer and that analyst I spoke of, your cotton plant, will tell you so during the season.

"You can not depend upon the color, smell or taste of commercial fertilizers, because it is quite possible to make the complete fertilizer, rich in phosphoric acid, nitrogen (or ammonia) and potash, as white as angels' wings or as black as Plutonic darkness.

"There are certain articles which, in the chemical laboratory test, will show valuable fertilizing ingredients, but in the farm test are absolutely worthless. These materials are known and are avoided by the honest manufacturer. They are classed as spurious and some States seek to legislate against their use.

"Before closing I should like to read to you a letter received from Dr. S. A. Knapp, Special Agent of the United States Department of Agriculture, as follows:

" 'United States Department of Agriculture,
" 'Houston, Tex., August 2, 1904,
" 'Room 17, Masonic Temple.

" 'Virginia-Carolina Chemical Company,
" 'Mr. George H. Tucker, Manager,
" 'Memphis, Tenn.

" 'Dear Sir: In reply to your letter of July 30, I will say that by our reports from all parts of the State, and by personal inspection of many farms, I am satisfied that there will be an immense increase in the demand for fertilizer next year. In every farm I have inspected where fertilizer has been applied the increase in crop has been from 25 to 50 per cent, at a cost of not over $2.00 per acre for fertilizer.

" 'We shall recommend to the farmers of Texas and Louisiana the free use of fertilizer for the ensuing year.

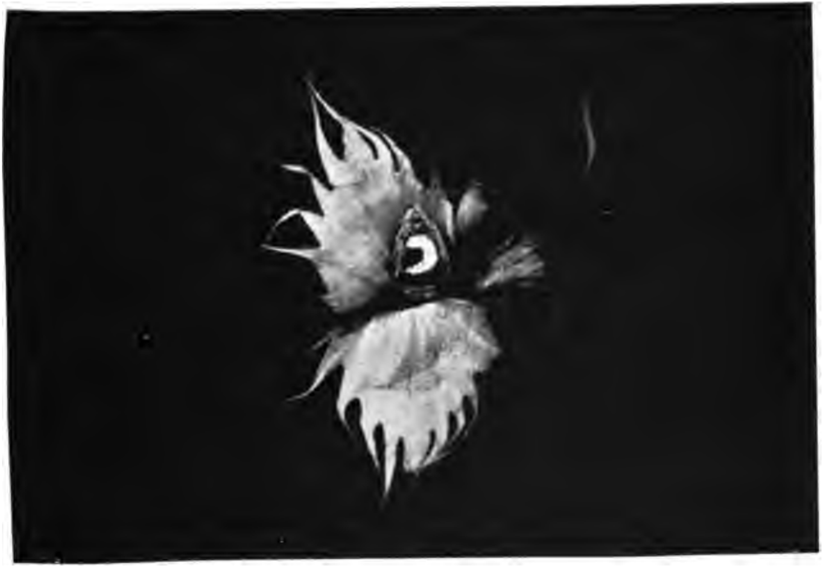
" 'Very truly yours,
"S. A. KNAPP,
" 'Special Agent in Charge.

" 'P. S. You can publish the above if you wish.'

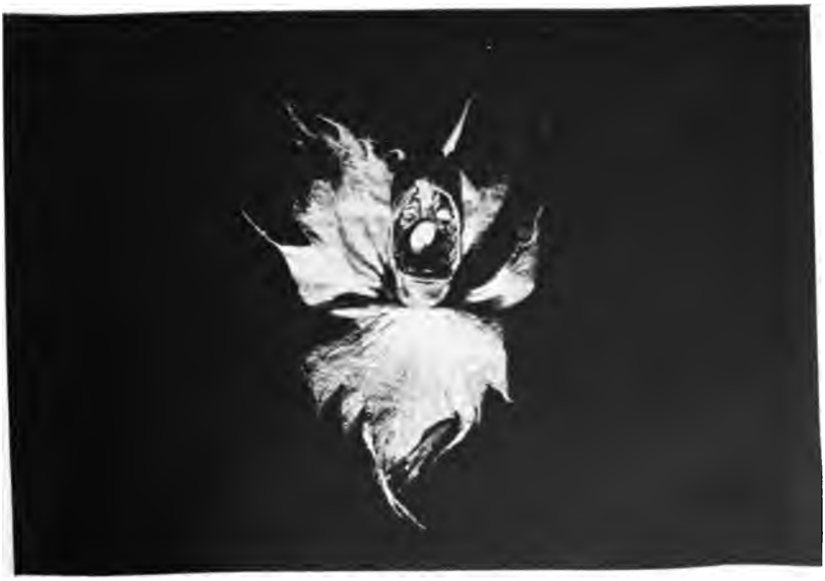
"It seems to me that all of this should convince you of the beneficial effects of commercial fertilizers. Let me say that fertilizers pay a better percentage of profit on rich, heavy land than on thin, poor land and more can be applied to the acre.

"I trust I have sufficiently interested you in this subject to induce you to make the trial for yourself."

Mr. Tucker's paper concluded the afternoon session, and the convention adjourned at 4 p. m. until 7:30 p. m., to meet at the Court House.



Full Grown Larva in Square - Nat. Size.



Pupa.

NIGHT SESSION.

The convention after recess met in the District Court Room at 7:30 p. m.

Congressman J. E. Ransdell, of Lake Providence, expressed himself as being heartily interested in the boll weevil subject, as follows:

"*Mr. Chairman and Gentlemen:*

"It gives me great pleasure to be with you on this occasion. I regard this convention, as stated by some speaker, second in importance to none that has ever taken place in the South. I regard the subject we are investigating of vital importance, not only to the South or to the United States, but to every citizen in the world, for I believe that cotton is the most important product in the world today.

"Statisticians estimate the entire product of steel and iron at $700,000,000, while the cotton crop exceeds that by $300,000,000, and three-fourths of the world's crop of cotton is raised in the South.

"It has been said that there is no product so important to the human race as cotton. If every grain of corn were destroyed, we could live in comfort on rye, wheat, potatoes, etc. So, if every grain of wheat were destroyed, we could live on corn and other products just as reasonably. But if the cotton crop was destroyed the whole human race would suffer, for there is no substitute for it. The cotton output of the world is twice as large as that of wool, and if cotton were destroyed the human race would necessarily be a great sufferer, for there is nothing that could be substituted for it as reasonably cheap.

"Cotton is the greatest single export of the United States. The export value of the cotton crop for the fiscal year ending 1903 was something like $350,000,000, while the export value of all other agricultural products combined—corn, wheat, potatoes, peas, all the lumber, the staves—everything combined in the world that is grown on the farm—everything of every kind and sort that is raised in this country from Maine to San Francisco, from Michigan to Texas, throughout the entire United States, was not $600,000,000. So cotton was more than half of all the others put together. That gives us some idea of what cotton as an export is—how important it is to the people of the United States—how necessary it is that Congress gives proper protection for it.

"One of the United States' brightest men, Henrý W. Grady, of Georgia, said: 'The ravages of the little insect known as the Mexican boll weevil of our great South's product is of more importance to England than the inroads of the Russians to Asia.' That being true, we can well call on Congress to give us money for protection.

"It will be of interest to you to hear a recital of the facts incident to Congress giving $250,000 for carrying on work against this pest, the boll weevil.

"Congressman Burgess, of Texas, who lives in the district ravaged by the boll weevil, called the members of Texas, Louisiana and Arkansas together for consultation, with the result that we made a call on President Roosevelt, who received us very cordially and seemed much interested, and said that he would insert a special word in his message. We told him that was very gratifying to us, but we wanted to know what he was going to say. He replied: 'Anything in the world that Mr. Wilson will write, I will put in my message.' We then went to see Mr. Wilson; he was delighted to see us, and as everyone knows has taken the greatest interest in this work.

"As the result of that effort—headed by the Texas members and assisted by Louisiana and Arkansas, Congress appropriated $250,000, and there was not one dissenting vote to the appropriation. I believe that the next Congress will appropriate a half million if the Depatment can use it successfully.

"I think that this convention should pass a resolution heartily endorsing the work of the Agricultural Department of the United States, showing that we are in sympathy with the work and what it has done for us. We should endorse the work of our own Agricultural Department for what they have done. Your representatives should be urged to join with Texas and other Southern States in asking Congress to give a liberal appropriation.

"I am convinced that the day will come when we will be able to entirely control this evil, just as we have been able to control every evil of the past that has tried to injure the human race. Until that day comes, however, we must keep up a vigorous fight. We can not afford to become alarmed. As wise men, we must carry on a vigorous campaign and prepare to meet the foe knocking at our door. If we meet this foe with the bravery and knowledge that is true to every Louisianian, I am satisfied that the disaster to our cotton will not be so great as it has been in Texas.

"We should take advantage of the lesson the Texas people have taught us. They have suffered more, because they did not know how to manage this evil. I trust this work will teach us how to do if it does not teach us to control it. Gentlemen, I thank you."

Mr. S. E. Russ, of Red River, read a paper reporting on investigations made though Texas. The paper was as follows:

"REPORT ON PROBABLE EFFECT OF BOLL WEEVIL IN LOUISIANA AND MISSISSIPPI.

"Austin, Texas, Oct. 22, 1904.

"*Messrs. J. Weis & Co., New Orleans, La.*:

"Dear Sirs—We are pleased to report that after a careful investigation, we find the boll weevil question, although very serious, not impossible to partially overcome.

"Our first spotting point was Dallas, where we learned every one had gone ahead without paying any attention to the weevil, which has been in that section in noticeable numbers for one to two years. The estimated damage this year, being very light. The same condition existed at Fort Worth.

"We learned at both places that the crop north of the T. & P. in Texas and the territories, was very good. The weevil has done no damage there.

"From Fort Worth to Waco, we heard more of the weevil and its ravages, and continued to do so as we went south. At

Italy, one of the finest sections on the route, the damage was stated to be 25 to 33 1-3 per cent, but the lands were so prolific that the surrounding country was more prosperous than ever before, owing to the price of cotton and seed this year and last.

"The weevil has been in this section for several years, but climate conditions are such that they do not multiply as fast as they do further south, where the damage is correspondingly greater. Lands all along this section were up to the top values.

"At Austin, we found the weevils numerous. They have made deeper inroad into the crop, cutting a normal yield of a half bale, to one-fourth of a bale to the acre.

"We learned in talking to bankers, merchants, and farmers at all points, that this year's crop, which seemed very short to us has caused no distress. Black prairie lands were still at the top prices of $40 to $75, the value depending on improvements, and none were for sale.

"Upon close inquiry here and at Taylor, our next stop, we satisfied ourselves that the prosperity in the black lands section of Texas was due to economy and not to the size of the crop per acre.

"This southern section, as well as Italy, was generally worked by foreigners—Germans, Bohemians, Italians, and Mexicans, all of whom, by their thrift, make money on small farms. They are extremely well satisfied.

"Boll weevils were as thick as could be in this section, nevertheless, every one who had planted cotton has gathered some. Not a single farmer expresses the intention of abandoning the staple for grain or other products.

"They figure here one-fourth to one-third of a bale to the acre, which, at present prices, they deem good returns for; and truck farming has not even been tried in this black land section. We might as well state here that the spirit of the people is to continue planting cotton, and those that have been the least successful only, talk of moving to other sections, but always to plant cotton.

"The cotton and oil mill owners need not worry over their industry coming to an end. The Southern farmer is going to make cotton and by the increased acreage and cultural methods keep up, at least, the present size crop.

"There is no reason that we know of why next year's crop of the whole belt may not be a 'bumper one,' if the season is favorable.

"In all of the above sections that we visited, we found no negro tenants. Those that we met were working for wages by the day or month.

"Seeing that none of the above black land prairie is similar to Louisiana or Mississippi in soil or labor conditions, we went to Hearne, on the Brazos River, where we found the exact conditions that we are accustomed to—sandy hills bordering alluvial lands of the finest quality, and presenting all the features of our sandy mixed and stiff river bottoms; all cultivated by large planters, handling from 1,000 to 4,000 acres, working principally negroes and a few Italians. The tenant and wage system, the same as ours, is in vogue here.

"Our investigation of these sandy and mixed lands, lifted our spirits to the highest point; for here we at last found a crop where weevils were thick, with every one confident they could do as well, or better, another year. We saw no crop under one-third of a bale, and up to three-fourths of a bale to an acre; most of them were making one-half of a bale to the acre on these sandy and mixed lands. They will average one-half of the bale to the acre, which, however, is only 50 per cent of the normal crop for this section.

"On the black, stiff bottom lands, we found in every instance, with but one exception, that the crop was a complete failure. Here the remarkable condition existed in the same field, exhibiting three-fourths of a bale per acre on sandy and mixed lands, whilst hundreds of acres of black stiff land yielded all the way from nothing to ten bales per hundred acres.

"Upon close investigation, we founnd in every instance, the disaster was due to the fact that the cotton did not start to grow and mature until too late. The nature of the soil thus effected is very cold and water sobbed. Many acres which were planted early had to be replanted. Others were too wet to be worked promptly; thereby early planting availing nothing, as the cotton stood still until too late. Under old conditions, these were the most valuable lands. We found one exception to this disaster on stiff lands. An Italian had a piece of well drained and very well cultivated land. He made half a crop, viz: one-half bale to the acre—doing as well as if it had been sandy or mixed alluvial land.

"We found in order to make a half crop, the following conditions are necessary:

"The land must be well prepared, all cotton must be planted early, and must be worked quickly and thoroughly. Further, that all efforts which had been made up to date, to poison, or use machines, had proved of no avail. We met many who have used Paris green through the season and who had run patented machines, and had no better crop than their neighbors, who had relied solely on thorough cultivation.

"Nothing is beneficial except getting the crop up early and pushing its maturity by rapid cultivation. The season may vary the yield from two-thirds of a crop in very favorable years to a little below one-half in a wet year, with an average of 50 per cent of a normal crop this year, in all sections, excluding the disastrous lands.

"In regard to planting seed, we find as follows:

"The King's Improved is admitted by all to be very early, but many thinking planters discard it as the smallness of the boll makes it hard for the pickers to earn full wages. Further, it wastes very easily, and lastly, the staple is so short that it has brought forth a vigorous protest from the consumers. Many claim that the better results have been obtained by other variety of seeds from northern climates, which, for one or two seasons, will make as early and as good a crop as the King's Improved, without having its three disadvantages.

"Adjoining the alluvial lands is a country similar to our hills and sandy post oak lands. Here, we regret to say, a complete failure has been made, 100 acres making from two to five bales—an absolute disaster.

"There are no fertilized hill lands in Texas. Therefore, no positive conclusion can be reached, regarding our fertilized hill territory.

"All we can deduce from what we have seen and heard is that on all light sandy hill lands, any bolls that are not specked by July 15th or August 1st, in some districts, will be destroyed by the boll weevil. All small bolls are surely lost, and the half matured ones are very badly damaged, by one or more pods being punctured.

"We have been informed that south of San Antonio the crop is a complete failure. It is a hot, dry country and the weevil becomes active so early that the very first forms are punctured. Moreover, this is a volunteer cotton country, producing food and breeding places one month earlier than planted cotton, which is, therefore, attacked at an early stage by the second generation of the weevil.

"We also hear that some of the planters have tried to raise a crop of volunteer cotton without any results.

"Truck farming is very successful in much of this district, which is so dissimilar to any of our country that we did not visit it.

"We are convinced that nearly all alluvial lands in Louisiana, Mississippi and Arkansas can be made to produce one-half crop under average conditions. What the fertilized hills will do, only time can tell.

"On our return home, our best efforts will be directed to study how to meet the conditions existing in Texas, should they reach our country, by experimenting with northern seed and fertilizer, to learn which will grow the biggest crop by August 1st; also to find a diversified crop for our stiff wet lands, which will not produce cotton profitably in boll weevil times. Further, to figure on reducing the acreage, as much rapid cultivation is necessary to beat the weevil.

"From the best information we have gathered, when the weevil appears in noticeable numbers with succeeding crops, one is reasonably sure of two crops. The third year, it will be cut badly unless the two previous years were very dry. Further, the weevil stays close to where it takes its start until late in the year, when it has eaten all the blossom and small bolls on its own patch, then it will migrate to the neighboring cut, and, finally, to another field and country, advancing forty or fifty miles a year; but always very late in the season. Therefore, if your neighbor is slow, your activity will pay regardless of any neglect on his part. Each man can fight this battle for himself.

"The boll weevil, as you have read, is a hard task master. Lands must be well prepared so if the early stand is lost, the second planting may grow very rapidly to make up. Then thorough and quick culture necessitates decreased acreage, making gross income much smaller.

"We may have to learn to live on a 5-cent basis, even if the cotton is selling at 10 cents, until such time as other antidotes are found than economy and thrift.

"Very respectfully,
"SIM WEIS,
"New Orleans, La.
"S. E. RUSS, JR.,
"Allen, La."

Following this a paper written by Geo. F. Neild, of Shreveport, on "The Interests of Cotton Exchanges in the Boll Weevil" was read by Secretary Giles. It was as follows:

"It is to the interest of all Cotton Exchanges that in the plans for the extermination of the boll weevil, care should be taken to preserve those qualities which have given American cotton its supremacy, and the United States of America a monopoly in cotton growing. The qualities for which the American product is prized are length and strength of staple. It is this difference in attributes that gives it pre-eminence over Surats and other growths of East Indian cotton, the staple of which is very short and in spinning requires a mixture of American cotton to make a satisfactory cloth.

"This fault in Surats, etc., it seems impossible to correct. During the Civil War, Great Britain imported seed as well as experienced cotton growers from the South, but after two or three crops grown on Indian soil, the staple deteriorated to that of native seed. Nature has bestowed a monopoly of cotton growing on the Southern States, so nothing has been done to question this monopoly until lately, when the world's consumption is running neck and neck with production.

Now, France, Germany and England, owning possessions of every variety of soil and climate, are straining every nerve to develop a section where cotton can be grown successfully to compete with American.

"It cannot be too strongly impressed upon all concerned, farmers, merchants, middle men and spinners, that while the weevil problem is being attacked, earnest efforts should be made to develop an early maturing seed that will produce cotton of not less than one inch to one and one-sixteenth inches on our hill lands. Many early seeds have been tried, but all have the same objection, the staple is very short, and if this is not corrected, spinners will go elsewhere for the kind of cotton they need and originally bought in this section.

"The question, however, assumes a more serious shape in that early varieties of short staple seed threaten the monopoly of American cotton."

The following interesting address was delivered by Mr. F. M. Muller, President of the Audubon Society, of New Orleans, on the "Protection of Insectivorous Birds." Mr. Muller said:

"The importance of bird life to the people of this State cannot be overestimated. Its consideration naturally leads to measures for their protection and preservation. The advocates of bird protection present two sets of reasons for the consideration of thoughtful persons, one sentimental, the other economic.

"The sentimental reasons are the ones most often urged, they are also of a kind to appeal with especial force to those whose responsibility for the destruction of our birds is greatest. Women and girls for whose adornment birds' plumage is chiefly used think little and know less about the services which birds perform for agriculture. Indeed it may be doubted whether the sight of a bunch of feathers or a bird's skin suggests to them any thought of the life that those feathers once represented. But when the wearers are reminded that there was such a life, that it was cherry and beautiful and that it was cut short merely that their apparel might be adorned, they are quick to recognize that bird destruction involves a wrong, and sometimes they are ready to do their part towards ending it by refusing to wear plumage. But in this address I do not propose to consider the subject from the sentimental side at all. In the first place it does not appeal to me, and in the second, the vital importance of birds to the economic welfare of mankind is so vast that to my mind it dominates every other consideration.

"Every one knows in a general way that birds render most efficient service to the planter, but although these services have long been recognized in the laws standing on the statute books of the various States (but unfortunately not on ours) it is only within a few years that any systematic investigations have been undertaken to determine just what these services are, to measure them with some approach to accuracy, to weigh in the case of each species the good and evil done, and so strike a balance in favor of the bird or against it. The inquiries carried on by the U. S. Department of Agriculture on a large scale, those made by various local experimental stations and by individual observers, have given results which are very striking and which can no longer be ignored. At a time like this when reports of the ravages of the boll weevil and other noxious insects are brought right home to us, any light thrown on the subject is found to be interesting to a large number of persons and with this view in mind the Audubon Society of Louisiana organized for the protection of our birds, invites your attention to the presentation of a few facts relative to the tremendous importance of this subject.

"It is said that three hundred millions of dollars that should go to the farmer, the planter, the market gardener and the fruit grower in the United States are lost every year by the ravages of insects—that is to say, more than one-tenth of our agricultural products is actually destroyed by them. The ravages of the boll weevil in the State of Texas alone for the past year is computed to amount to a loss to the planters of that State of the enormous sum of forty-nine million dollars. Now as the beneficent rain which falls from the kindly heaven onto the parched earth below is the natural check to drought, so birds are the natural check to insects for what are pests to the planter are necessities of life to the bird. It is calculated that an average insectiverous bird destroys 2,400 insects in a year, and when it is remembered that there are over 100,000 species of insects in the United States, the majoritiy of which are injurious, and that in some cases a single individual insect may become the progenitor of several million decsendants, it is seen how much good birds do ordinarily by simple prevention.

"It is well known that of the various groups of birds the majority live upon insects. Among the insect eaters are the fly catchers, warblers, woodpeckers, nuthatches, orioles, tanagers, gnatcatchers, kinglets, vireos, thrushes, wrens, titmice, cuckoos, swallows, strikes, thrashers, creepers and bluebirds.

"It is not generally known that the so-called seed eaters feed their young largely upon insects and eat a great many themselves; nor is it realized how much good they do by eating weed seeds. Prof. Beal has calculated that the tree sparrows in the State of Iowa alone, eat 1,700,000 pounds of noxious weed seeds during the four winter months they are residents there.

"I could go on for a long while giving you facts and statistics to prove my assertion of the astonishing importance and value of the birds to our welfare, but the repetition would only tire you, and in order to make this talk more interesting we will now consider a few of our most common resident birds and learn wherein their value lies.

"The first bird is the blue jay:

"The blue jay is a common bird of the Eastern and Southern United States, and in this section of the country can be found at all seasons of the year. During spring and summer the jay is forced to become an industrious hunter for insects and is not so conspicuous a feature of the landscapes as when it roams the country after the cares of the nesting season are over.

"Ornithologists and field observers in general declare that a portion of its food in spring and early summer consists of the eggs and young of small birds, and some planters accuse it of stealing corn to an injurious extent in the fall. While there may be some truth in these accusations, they almost certainly have been exaggerated. No doubt many jays have been observed robbing nests of other birds, but thousands have been seen that were not so engaged.

"An examination of the stomachs of many birds proved that one-fourth of their food consisted of animal matter and three-fourths of vegetable matter. The insect food was made up of beetles, grasshoppers, caterpillars and a few other species, all of them harmful insects. Corn is evidently a favorite food, but a close inspection of the records show that the greater part was eaten during the first five months of the year and that very little was taken after the month of May, which indicates that most of the corn is gleaned from the fields long after harvest time is over.

"The results of the investigation show that, first, the jay eats many harmful insects; second, that he has been accused too much of robbing nests; and third, that he does very little harm to agriculture, but on the contrary is a positive benefit; so it is right that we should add him to our list of highly useful birds.

"The next bird is the red-winged blackbird:

"To hear some people voice their sentiments regarding this bird, one would suppose he was so vile that even hanging was too good for him. But just at this time when planters all over the country are calling attention to the frightful depredations of various species of weevils, it might be well to say that these terribly destructive insects are one of the articles of food in the red-winged blackbird's bill of fare. Prof. Beal, from whose valuable work a great deal of the information in this address has been taken, says that in the month of June, 25 per cent of the food of these birds are weevils, and as weevils are one of the most harmful insects known, their destruction should atone for at least some of the sins of which the bird has been accused. But the most important item of this bird's food is weed seed, which forms practically the whole of its food in winter, and over one-half the whole year's bill of fare. The principal weed seeds eaten are those of the ragweed, barn grass, smartweed and about a dozen others. Taking all these facts of the case into consideration, we are justified in naming this as one of the most useful and beneficial birds, and it ought to be protected for the reason that its presence is absolutely essential to keep down the hordes of harmful insects that otherwise would destroy the crops, and the never ending crop of weeds that makes so much additional labor upon the plantation.

"The next bird is our old friend, Bob White:

"In some parts of the country he is called a partridge, but as there are no true partridges in this country, we will be correct in calling him a quail. And a most important part he plays, although very little credit is given him. In the low growing grasses he finds his food, and although the grasses have a comparatively restricted set of enemies, nevertheless they are sufficiently numerous to seriously injure the crop if it were not that our friend Bob White seems born with a determination to rid the world of these evils. In the roots of the grasses he finds white grubs—the destructive larvæ of the common May beetle or June-bug, also wire worms. In that part of the plant just below the soil surface he finds the meadow maggot—the peculiar larvæ of the crane fly, and just above the soil where the fatal work of the cut worm and army worm is carried on, Bob White finds many a dainty meal; and with bringing grasshoppers and chinch bugs to a sudden end he industriously passes the day, doing all he can to help the planter, who mean while—utterly indifferent to all this highly useful and philanthropic work—is calculating how many tid bits there are in the covy to satisfy his craving desire for game food. It is remarkable that the quail is one of the comparatively few birds that seems to esteem the chinch bug a delicacy, and this insect is one of the very worst pests the planters have to contend with.

"But do not imagine that while insects are by far the most destructive agencies with which the birds have to do, they are the only ones. The great group of birds of pray, of which hawks and owls are the most familiar examples, serve a very useful purpose in keeping in check mice and rats, which otherwise would prove very troublesome.

"In some regions where hawks and owls have been ruthlessly destroyed, the damage from field mice has been very great. The indiscriminate destruction of all species of hawks and owls simply because some of them catch poultry, is a foolish and wasteful practice. As a matter of fact, nearly all hawks and owls feed upon mice and insects almost exclusively, and seldom or never take poultry. Of the eight species of owl which reside in this State, I particularly refer to the barred or common hoot owl, one of the owls which lives with us all the year. Most people think it a privilege to shoot this bird on sight, and yet its food as determined by those who have studied it long and carefully, consists chiefly of mice and insects. At nightfall these birds begin their rounds, inspecting the vicinity of farm houses, sugar houses, corncribs, making trips through the garden, gliding silently across the fields in search of their prey. Thousands upon thousands of mice of various species fall victims to their industry. Their economic relations therefore are of the greatest importance and whoever destroys them through ignorance or prejudice, should be severely condemned.

"The commoner hawks also are beneficial, destroying great numbers of mice and insects. It is all right to trap or shoot a hawk that is known to rob a poultry yard, but it is a great mistake to kill these birds indiscriminately. The only ones of the eighteen species found in our State which are known to be guilty of destroying fowl are Coopers hawk, or the blur darter, the duck hawk, the sharp shinned, and to some slight extent the red tailed hawk.

"Of the hawks that may be said to be harmful, this latter species is the most inoffensive, and because it will occasionally steal chickens and kill other small birds, it seems that these criminal acts are an incentive for every one to berate the whole tribe of hawks and to condemn all indiscriminately, and at the first opportunity many persons will proceed to kill every hawk on sight, little realizing and caring less, that the diet of nearly all these birds is made up of mice, insects and vermin that are especially harmful to all vegetable life. There is no doubt that the red tailed hawk does considerably more good than harm, and like every other good citizen, it ought to be protected.

"It is certain that without the services of these feathered laborers, whose work is unnoticed, though it lasts from daylight till dark through every day of the year, agriculture in this country would come to a disastrous standstill; and if in the brief season of harvest, each one of these workers levies on the planter a small tribute of fruit or corn or fowl, the price is surely a small one to pay for the great good done.

"Superficial persons imagine that the birds are here only during the summer time, but this is a great mistake. It is true that in warm weather, when insect life is most abundant, birds are also most abundant. They wage an effective and unceasing warfare against the adult insects and their larvæ, and check their active depredations, but in winter the birds carry on a campaign which is hardly less important in its results. It is then that the chickadees, the wrens, the woodpeckers, the blackbirds and numerous other species are hard at work all through the short days, searching the crevices and crannies in the bark of the tree trunks and branches, looking among the undergrowth, hunting along the fences for bunches of eggs, the buried larvæ and the pupæ of insects, which if undisturbed would, when warm weather comes, hatch out millions of creeping, crawling and flying things to devastate the garden and every crop of the field. It is through this silent, unceasing work of the birds—some in summer and others in winter—that insects, weeds, mice and vermin are held in check, and that wonderful balance in nature of bird life set over against pest life is maintained; and only dire disaster is bound to result to any people who do not fully recognize these facts and by the rigid enforcement of the legislative enactment which we have so happily secured, give the birds the protection they so richly deserve.

"The hardy and worthy people who settled this State one hundred years ago found an abundance of wild bird life that was well nigh fabulous. They were surrounded by such multitudes of feathered guards that for years and years insect enemies of every specie were practically unknown.

"Without pausing to consider the tremendous importance of this fact, they began a war of destruction upon these feathered friends.

"In eighty years they and their successors had absolutely exterminated the passenger pigeon; in ninety years the prairie chicken was gone, and with it the snowy heron and laughing gull from the Gulf parishes. And now at the close of this period we are bound to confess that the wild turkey and quail are almost sure to go the same way.

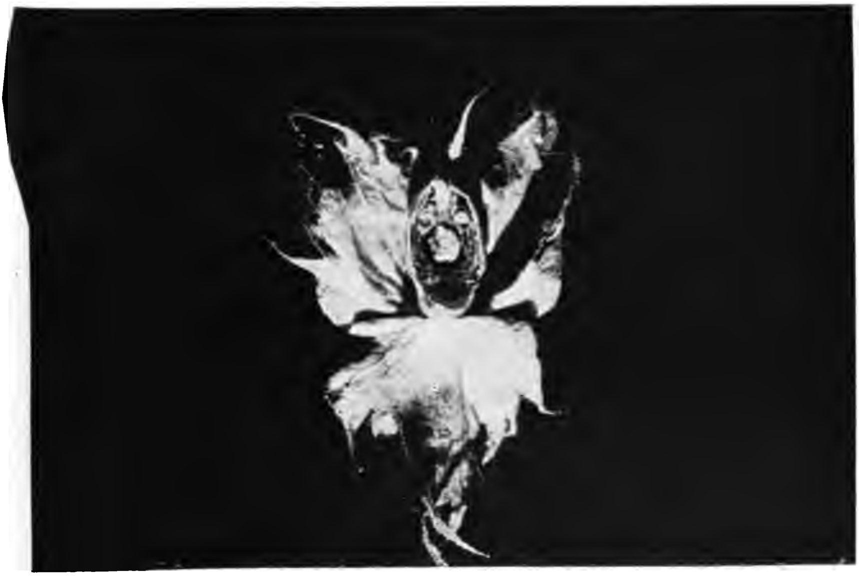
"Along with this destruction of our wild game birds went that of our non-game birds, such as the rice bird, the meadow lark, the jackdaw, the mocking bird and many other species of valuable birds. And what has been the result? *This convention for one thing!* and in this discussion of the best methods to combat the cotton boll weevil I stand here and challenge the production of any one scheme that will eventuate in that hoped for result. Everything has been tried except a return to natures ways and means, and I solemnly declare that the time has come when the agricultural interests of this State aroused to the peril which confronts them must demand the absolute protection of all insectiverous birds so that we may begin to retrace our steps, to undo the wrong done in the past, and by united effort secure a return of those battalions of feathered friends which in our indifference and folly was permitted to be destroyed from off the face of the earth without one word of protest being raised against such a suicidal practice. You might as well attempt with the aid of one foot levees to keep out the resistless current of the mighty Mississippi rolling its yellow flood to the Gulf, as attempt to keep out or rid ourselves of the threatened invasion of this pest unparalleled without the aid of the agency which nature created for this very purpose."

At the close of his address Mr. Muller was asked: "How about the English sparrow?"

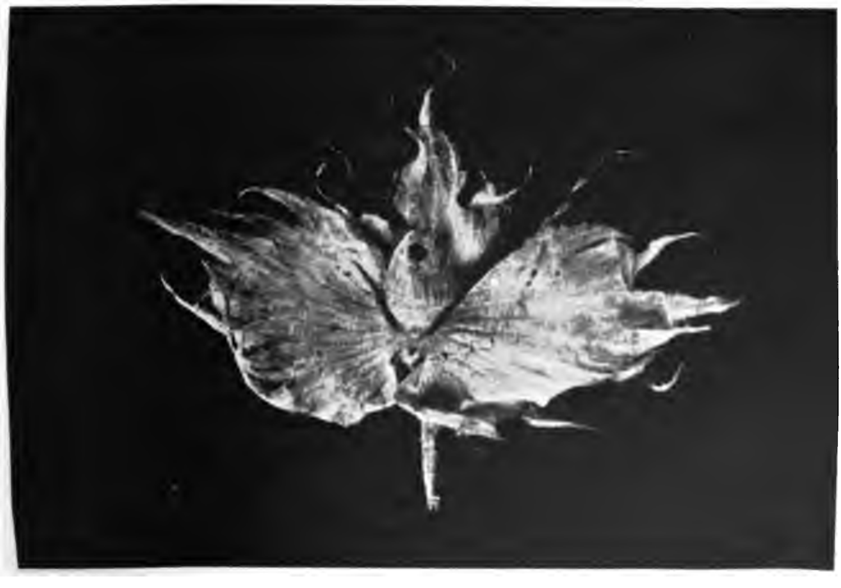
He replied: "I have no apologies for him. He is a foreigner—I am only taking care of our own birds."

Capt. W. B. Marston, of East Point, read an interesting paper on "Experiences in Poisoning the Boll Weevil." His paper was as follows:

Plate IV.



Just Reached Adult Condition Within Cotton Square.



Emergence Hole Made by Weevil in Square—Nat. Size.

"*Mr. President and Gentlemen:*

"In approaching this question I prefer to give a few facts, recognizing that one fact is worth one thousand theories. I spent the months of April, May, June, July and August of this year in the boll weevil districts of Texas and devoted all the time and money I had, during these months, exclusively to this question. I had known, from hard, personal work and long experience, that the cotton caterpillar and boll worm and potato bug could be poisoned effectively to save a crop from their depredations, and believed when I 'invaded' Texas that there ought to be some way to poison the boll weevil, though the information on that point was very, very discouraging. Dr. L. O. Howard, Chief of the Entomological Bureau of the United States Government, in line with the whole fraternity, wrote in the *Review of Reviews,* as late as February, 1904. He said: 'It has been found to be impossible (note the word impossible) to poison the weevil in the field. It is a hard-shelled, tough little creature, very resistant to the action of contact poisons, and in a very extraordinary degree resistant to internal poisons, such as arsenic in its various forms. Its larvæ lives hidden within the 'square' or boll, where poisons can not reach it.' All through and in or between the writings of the experts, both of the State of Texas and the United States Government, poisoning of the weevil was discouraged, and, indeed, it had been abandoned when I 'invaded' Texas on the 5th day of last April. Wherever I went the people laughed at my efforts, and they were so skeptical at LaGrange, Tex., that I offered to eat all the live weevils found in the field after poisoning; but the next day, when all that could be found were dead, the good people at LaGrange became my warmest supporters and, from results obtained, are today. I have not been able to learn of a single stalk of cotton being poisoned by any one in the whole State of Texas for the boll weevil during the year 1903, though the weevils were exceptionally bad last year.

"But to go on with this narrative. At Houston on April 8th I learned that there were at the Cotton Exchange a lot of weevils, just out of a field at Lockhart. They had been bottled up for five days and were naturally hungry and thirsty. I got a lot of these boll weevils, took a street car for the nearest oil mill, obtained a few volunteer cotton plants, went to my room at the Brazos Hotel, and in utter astonishment saw with my own eyes these hungry and thirsty bugs graze over these cotton leaves like pigs grazing on a lawn! They drank water like house flies! I sifted a minimum amount of dry Paris Green over these leaves and saw these bugs, the *anthonomus grandis bok,* the common boll weevils, nothing else, watching them with a strong glass, eat some of this poison. I carefully put them away and the next morning they were all dead. I reported these facts to Governor Heard. He gave it to the press, and it spread all over Texas like a prairie on fire. But not satisfied with this 'office' experiment, so to speak, I began work in the open field at Lockhart, Tex., and poisoned the weevils appearing on the volunteer cotton in the field of Zach Zachrie, and found that the weevil just out of his winter hibernation was as easily poisoned as the leaf worm or caterpillar or the ordinary potato bug, as they feed in the bud of the cotton and sip the honeydew of Heaven from its leaves. We screened some of the cotton stalks with ordinary mosquito netting and upon one stalk we killed three separate lots of weevils we had gathered in the field, at intervals of two days for a whole week, with only one poisoning, and in the meantime the weevils had disappeared from all the poisoned cotton in the open field, finding many dead ones. In cotton in near by fields, not poisoned, the weevils were constantly increasing. The efforts of this early poisoning has lasted to this day. The cotton producing from 50 to 100 per cent more than that in fields situated in every respect like it, except they were not poisoned. There are many instances in Texas to prove these conclusions. It was apparent to every one who has inspected it in the Henderson field at Lockhart and on the McCurdy farm (Rev. J. M. Purcell) near Lockhart. Mr. Purcell made two most exhaustive experiments, one upon a piece of early cotton and one upon a piece of late cotton. In both instances he doubled or quadrupled his crops over the crops surrounding him, and in the same field, where no poison was used.

"Mr. Purcell's letter could not be obtained for use with this letter, for which I am very, very sorry, but it is one of the finest contributions yet written on this great question.

"In this connection I will read some interesting correspondence with Governor Heard and myself.

GOVERNOR HEARD'S LETTER.

"'Baton Rouge, La., April 25.

"'Capt. B. W. Marston, Lockhart, Tex.

"'Dear Captain: I have just received your favor of the 23d instant, and note with satisfaction your success in dealing with the much discussed and destructive boll weevil. I have received several letters from you recently on this subject, but have been too closely engaged on my message to the Legislature to answer them as received.

"'I want to congratulate you upon the intelligent and painstaking manner in which you have gone after this insect and upon the success which has attended your efforts so far. I hope that your remedy may prove as efficacious later in the season as it has in the beginning.

"'Be assured of my warmest approval of your indefatigable efforts to accomplish what others seem to think impossible. I have felt satisfied all along that a remedy could be found and it will be the more gratifying to know that it has been accomplished by a Louisianian, and by one for whom I entertain such high regard and confidence in his ability to do things.

"'With assurances of my high personal regard and esteem, I am,

"'Yours truly,

"'W. W. HEARD.'

"'Lockhart, Tex., April 29.

"'Gov. W. W. Heard, Baton Rouge, La.

"'Dear Governor: Enclosed find a clipping from the San Antonio *Express,* which is the strongest endorsement of my success with the boll weevil. You see this man has been using my remedy for the destruction of the cotton caterpillar and boll worm—the remedy I invented myself—to destroy the boll weevil, but has kept it to himself. Now, O. L. Ekhardt, well and favorably known in this section, has given away the secret, since I have published it to the world, and does me the justice to say I had correctly stated it.

" 'I write this to you because certain parties in Texas are claiming that Professor Malley, for whom I have the highest regard, deserves the credit for this discovery. The facts are Professor Malley had been whipped out of this business for some time and has retired to the privacy of his farm. Professor Malley, as I understand it, from all of his official reports, never got further than I did, from 1870 to 1880, with spraying machines. All spraying machines are infernal (I use the word in its strongest sense) humbugs, and if you remember I so stated this in a speech I made before the boll weevil convention held in New Orleans, upon the advice of which you called the special session of the Legislature to organize the Crop Pest Commission of Louisiana. You will also remember in that convention I stated boldly that the boll weevil had no terrors for me. That in spite of the theories and published experiments of the Entomological Bureaus of the United States Government, that the boll weevil could be poisoned with Paris Green properly administered and applied. You will also remember that I told you and the Crop Pest Commission that I thought we ought to send a man into Texas on the battle line to fight this pest. The Commission thought otherwise. I then told you and the other members of the Commission that I would myself go into Texas, on my own responsibility, pay my own expenses and make this fight myself. You will remember further that I made about this same statement in my speech at Negreet to the people of Sabine Parish. The balance has been told since I came into Texas on the 5th day of April. Now, why any man or set of men should want to 'steal my thunder' is beyond my comprehension. I found the people of Texas as a unit, as far as I know, opposed and incredulous to any such 'monstrous ideas' as the ones suggested by me. I have fought this thing night and day now for three weeks by hard knocks, and the victory is mine, if it is a victory. The battle is now on and I throw the gauntlet down and say, 'Lay on, McDuff, and demned be he who first cries, Hold! Enough!'

" 'I write you thus freely and expect the people of Louisiana to stand by me in the claim that I was the first man in that State, or any other State, to destroy the cotton caterpillar, and it is upon this same system that I have won the first victory against the hibernated boll weevil, and when he is destroyed the problem has been solved. If they appear later in June and July, like the locusts of Egypt, I propose to destroy them in the same way. This, I think, will not be necessary, if the hibernated weevil is universally destroyed.

" 'Dr. Howard, Dr. Hunter and Prof. Jefferson Johnson stood me down in Austin the other day, all claiming that the boll weevil would appear again and again in June and July in countless myriads and could not be destroyed, and claimed, as I understood them, that these would be the hibernated weevils. I frankly told them that I could not understand it, and that I would have to see it to believe it. If the present hibernated crop of wevils is killed out, in my opinion, upon every stalk of cotton, on every row of cotton in the State of Texas, there will be very, very few to follow after them. Time will tell, and in the meantime I believe the cotton in the boll weevil district of Texas will have taken on sufficient fruit to insure a good crop. On the contrary, if they are allowed to go Scot free, when an expenditure of possibly not over 10 cents per acre will now destroy them, the result may be insurmountable.

" 'I can't believe the people of Texas will 'play 'possum,' as the boll weevil does, and let this great disaster overtake them. The Boards of Trade of LaGrange, Cuero and Lockhart have already adopted my plans, and I believe the balance of the State will soon take it up. If it does, I await the result with absolute confidence.

" 'Yours truly,
" 'B. W. MARSTON,
" 'Crop Pest Commission, Louisiana.'

"I could fill a large volume with the most flattering testimonials of the early successes of poisoning the hibernated weevil, but I will only tax your patience with a few:

" 'Highbank, Texas.

" 'Dear Sir: Cotton that I poisoned three times will make double as much as that not poisoned at all. The poison is a good thing, if done early. Will poison again next year if I raise cotton.

" 'J. H. CLUCK.'

" 'Cuero, Texas.

" 'Dear Sir: Your favor of August 3d received this afternoon, and beg to say that my experience in poisoning cotton with Paris Green by your plan I consider very satisfactory. In fact, the cotton that I have kept poisoned looks more like old time cotton and will make more per acre than anything I have owned since the advent of the boll weevil. Many prominent farmers have visited my cotton patch recently and none have left unconverted as to the merits of your remedy. You ask how my poisoned cotton compares with that which was not. Cotton which has been poisoned five times will make fully one-half bale to the acre, if not more. Cotton poisoned two and three times will make a bale to three or four acres, and cotton which has not been poisoned will hardly make the seed I planted. In fact, where I have poisoned regularly and systematically I have never failed to put the boll weevil, boll worm and all other insects which prey upon the cotton plant out of business, and so sanguine am I, and for the benefit of the farmers of this section, I challenge Mr. Hunter and his entire corps of bug-hunters, that I can make a better crop of cotton at less expense by your remedy than any of them under the cultural method or any other they may suggest, and if Mr. Hunter or any entomologist of this State wishes to enter into a contest of this kind, I will deposit $500 in any bank in Cuero as a guarantee of good faith, and prove to them and the people of Southwest Texas that the Paris Green remedy is the only salvation now in sight.

" 'Trusting that some day I may have the honor of shaking you by the hand, I am,

" 'Yours truly,

" 'JOHN T. SHANKS.'

"Notable among the best citizens of Texas, who have succeeded in poisoning the boll weevil, are: W. D. Kyser, of Marlin; John Schumaker, of LaGrange; A. J. Dossett, of Cameron; L. F. Roberts, of Beeville; William Stein, of New Berlin; J. H. Cluck, of Reagan; John T. Shanks, of Cuero; J. M. Purcell, of Lockhart; Pleas Butler, of Kennedy; M. A. Withers, of Lockhart; J. E. Harville, of Belton; J. H. McCampbell, of Hebbronville; S. E. Barnes, of Trinity, and many, many others.

"*Per contra,* many have failed, and why? Only look over the beautiful Valley of Red River today and show me the successes in poisoning for the caterpillar! To every one successful I will call ten or one hundred who failed! And men of experience! Yet will any one contend that the caterpillar can not be controlled with the judicious use of poison? In passing lately through our friend, Mr. Ivy's, field, while he was at the St. Louis exposition (I only mention him as a typical case, because he can stand it) I saw his hands poisoning (?) cotton. They would shake their poles about every thirty steps, and seemed to be laughing and talking to each other as if it was a good joke! I watched that field several times in passing and the way the caterpillar was going for it—they seemed to be laughing at Mr. Ivy! The half-hearted way in which nearly all the poisoning is done in both Louisiana and Texas is a disgrace even to the 'cultural methods.' When the weevil appears, in order to meet it successfully with poison, it has to be done with loaded 'guns.' Just as the Japs have met the Russians, and it will have to be done with organization different from what has been had in Texas. If every renter can say, 'I have been in Texas forty years and I know! I have been in Louisiana ten years and I know! My great granddaddy 'pizened' cotton afore I was borned, and I know! I would as leave put sand on my cotton as Paris Green, and I know!' then, gentlemen, the 'jig is up,' and the boll weevil, as Mr. Hunter, United States Entomologist, has said, will certainly infest the whole of the cotton-growing area of the South, at possibly a cost of $250,000,000 per annum. I can only compare an infested boll weevil district with an infested yellow fever district. It is easy to control in its incipiency, but once run wild, and it is the devil and Tom Walker, whatever that is. But it was whipped in its worst phase by the Rev. Mr. Purcell, of Lockhart, as attested by many of the best citizens of Lockhart, and by both of the newspapers, though Mr. Purcell is too modest to claim all the credit he deserves himself.

"I will append the rules I got up last season to apply Paris Green, and if they are adhered to the boll weevil, I repeat with the facts before me, has no terrors for me! I say this in the face of the Texas Commission and the Louisiana Commission, neither of which, as I think, have done me the justice I deserve for the five long months of the hardest work I have done in years and years. I have no war to make with the Louisiana Commission. They have ideas of their own, and I like that. When they say a horse is sixteen feet high, they will die by it. If they won't, I will, and that settles it!

"It was in vain that I tried to get any amount of this work inspected by the Texas Commission, though I addressed two letters to the Governor of Texas, demanding under the law of Texas that he should have it done. The inspections made by the Texas Commission were of such a farcial nature that one would think they were veritable greenhorns fighting the boll weevil. You see, I am told that there are over six hundred applicants for that princely reward of $50,000 which the State of Texas offered for a successful remedy for the boll weevil, to save her from a destruction of possibly $80,000,000 per annum, and men from Maine to California, and from England, France and Germany, who never saw a boll weevil, nor had had any practical experience as farmers in fighting pests of any kind, bothered the Commission. So they appointed meetings to offer every man a fair shake. And such doings, and such carryings on you never did see! And all to the amusement of the boll weevil! One would have thought from experiments had that it was to be done by 'sleight of hand' or a trick of legerdemain. Gentlemen, it takes five months to fight the boll weevil after its infestion has become set. If every one would take it in time it can be nipped in the bud, but this looks like an almost impossibility, because I fear we have too much 'knowledge' (?) to combat. I heard a negro say the other day that 'no man could tell him that 'pizen' would do any good, except kill the cotton.' I told him that I knew I had made cotton make 75 per cent more by judicious poisoning than it would have made without it, as proven by cotton left not poisoned on the spot. He went off with the same opinion still. In order to get the people of Louisiana organized to fight the weevil, like fighting fire, or an epidemic, I tried to get the Louisiana Commission to go with me, or without me, to Texas and inspect the work I had done in Texas for five months this year, so that we could get it before the people of Louisiana officially, and try and organize a campaign of extermination early next Spring. The Executive Committee declined, and some correspondence between Mr. Frierson and myself has been published about it. At a meeting of the whole Commission in Baton Rouge the other day I again requested that my work be inspected, but I think between other engagements and other pressing duties, it was found to be impracticable, and possibly indelicate to our sister State of Texas. This is my idea. Well, Texas is a free State and a good one. Its people are our kith and kin. The boll weevil is paying no respect to the dividing line between Texas and Louisiana, and I don't consider that this is a State fight. The mention, though, of that $50,000 reward officially in the State of Texas is like shaking a red rag at a bull! It accounts for the milk in the cocoanut! It will never be paid to any man. It may be paid to his heirs by some act of shame, passed by some future Legislature. 'Oh, he is after that reward!' is enough to damn any man in Texas among the *en-to-mo-log-i-cal* fraternity, and I know whereof I speak.

"But this is a serious proposition and one that I have put my whole heart and soul into, almost to the abandonment of my own private business. No other man that I know of in Louisiana or Texas has done it, and I don't know but what I have been very foolish to do it, in the face of the opposition I have had. Well, I have not told it all, and I don't know that I will.

"I tried my level best to gobble up that little $50,000 offered by the State of Texas. I did not think it was any crime, as the competition was open and honorable. I know there are men in Texas who say that I will not have earned it, even if my process downs the weevils, and the people of Texas adopt the method after its success with two years' trial, conditions necessary to obtain the prize, because some Tom, Dick and Harry had used 'pizen' before I was born! All who used it on the boll weevil failed. And when I used it successfully in the fields at Lockhart and LaGrange, last April, on the hibernated weevil, poisoning, not top rows, as had been done before, but every row, and every stalk in every row, the people of Texas were in the throes of despair; Louisiana had risen as one man and organized a Crop Pest Commission to fight the pest. The United States Government was fighting it, led by its brainiest men—such men as Dr. Knapp, Dr. Hunter, Dr. Howard and Secretary Wilson—and not one of them had suggested the use of poison to combat it. It makes me sick at heart to see the contemptible opposition to this great work of mine, and I know whereof I speak. There are men fighting the success of this method of mine today who never saw a boll weevil, who never did a moment's work in a cotton field in their lives, just because, as I honestly believe, it may stop the appropriations! Well, if it is in this spirit that we are to fight the boll weevil, I have only to exclaim, in the language of the Lockhart *Post,* 'Good bye, Louisiana.'

"But, gentlemen, whether I am right or wrong in my ideas of this momentous question, I know one thing: Without organization there will be no fight. Every ward and every settlement in every ward, in every Parish in this State, where the boll weevil is, should be organized to fight the weevil in every way known. But at last, if I am not wrong again, the last one of you, and Texas and Louisiana, will fall back on Marston's plan of poisoning the boll weevil. These plans of mine for fighting the caterpillar and the boll worm have not been improved upon in thirty years. For these reasons I wanted the work I had done in Texas this year inspected. I did not want it treated with indifference. I wanted it reported upon, and if advisable endorsed, so that the people would have more to go upon than the assertion I make, even with the incontrovertible proofs I will have given you.

"But if you organize anyhow in every neighborhood and poison early, and, as necessary, often, my word for it you will whip the boll weevil. Had the people of Texas taken my advice and as one man poisoned their cotton, as Mr. Barnes, of Trinity, did, and had killed out the hibernated weevil, you would not have them now flying over into Louisiana 'hunting new fields and pastures green.' They would have had enough to do at home, eating Mr. Barnes' poison.

"Allow me one word upon cultural methods. Without them you had best go out of cotton. The great Dixon, of Georgia, years ago taught us how to raise four bales of cotton per acre on the poor hill lands of Georgia. His methods have never been improved upon, and in my opinion never will be. But cultural methods have not and will not check the boll weevil. Climatic conditions may. Poison certainly will.

"Read what the Williamson County, Texas, farmers say:

" 'WILLIAMSON COUNTY FARMERS.

(Houston Post Special.)

" 'Taylor, Tex., October 9.—The Williamson County Farmers' Union closed an enthusiastic two days' meeting in Taylor yesterday afternoon, with President G. W. Lawrence in the chair, Secretary H. B. Hoover at the desk, and seventeen local unions represented.

" 'A committee, consisting of Sam Jarrell, Lee Baker and W. D. Lewis, appointed to visit the Government's experimental farm near Taylor, submitted the following report:

" 'We, your committee, appointed to visit the agricultural experimental station located near Taylor, to demonstrate the advantages to be derived by scientific cultural methods as a preventative against the ravages of the boll weevil, beg leave to make the following report: We visited the farm on September 1st and were cordially received by Manager C. C. Hooper. He spared no pains in showing your committee over the farm, and answered all questions to our full and complete satisfaction.

Our conclusions are that the scientific cultural methods are not preventative against the ravages of the boll weevil.'

"By order of the Farmers' Union the State press was asked to give publicity to the above report.

"Understand, I am not making war upon any cultural methods of anybody. But I want to emphasize the fact that wherever in Texas the best cultural methods have been used, the spread of the boll weevil has been worse. The boll weevil thrives best in the best cultivated cotton. Yet these men tell you, 'Let her go, Gallagher!' We will circumvent him with phosphatic acid, early cotton seed, and a big hurrah, and lots of humbug. These gentlemen forget that the geat drought in Southwestern Texas this year prevented the early cotton from coming up, and that the 'phosphats' dried up, and the weevil was left in his glory! We have droughts here, also overflows, just as they have in the Brazos river bottoms, where the weevil glories in his freedom and waxes fat on cultural methods. Will you fall down and worship this false god with such experiences before you? Or will you prepare for contingencies? The great Napoleon said that the god of battles was on the side of the heaviest artillery and the dryest powder. Gentlemen, follow up the best cultural methods, but when you go up against the boll weevil have your Paris Green dry, and remember General Taylor's words at Buena Vista: 'Give them a little more grape, Captain Bragg.'

"I wish I could approach this great question with a little more equinimity, as gently, for instance, as Grover Cleveland would wade a stream, casting his fly upon the limpid waters. But, gentlemen, that $250,000 appropriated by Uncle Sam to destroy the boll weevil, and misappropriation to 'cultural methods' has too many loyal adherents for me. Wherever I went in Texas, I found those gentlemen 6,000 strong, I believe, advocating 'cultural methods,' with free passes over all the railroads, and they were downing and belittling the Paris Green remedy wherever they could. Read the letter of Mr. Harville, of Belton, Texas:

" 'Belton, Texas, October 18.

" 'Capt. B. W. Marston, East Point, La.:

"Dear Sir and Friend: Have been wanting to write you for some time, but not knowing your address, hesitated until seeing your communication in *Farm and Ranch,* issue of October 15th.

" 'Since hearing your address in Belton, May 14th, on boll weevils, I feel that you are my benefactor for thousands of dollars in the next few years. You have saved for me this year $500 and it would have reached $1,000 had the poisoning not been delayed by sickness—measles—in the family. We are writing you as a friend and there is no need of giving results of poisoning, as they have been entirely satisfactory in every respect, and feeling and positively knowing you have given us the remedy for the boll weevil, will not be afraid of planting on a larger scale in the future. My only regret is not knowing earlier, for which thanks to you.

" 'There has been very little satisfactory poisoning done in this country this year, for the reason that within one week after you made your speech a great many, and some of them prominent, men talked against your poisoning and made pencil calculations against it, and people became prejudiced against it, consequently but few used it, and most of them made one application and then sat down and let the weevil have it, and then condemned the method. I know of only three men in the County who have followed your instructions, and every one of them is just as well pleased as I am. I tell them one time poisoning is simply a waste of money. Then Mr. George Knapp slips into the County and gets testimonials from these one-time poisoners condemning your method, and published in *Farm and Ranch.* I told the people George Knapp could not find a man in the State who had used the poison as you instructed who would give any such testimonials. He was simply hunting testimonials adverse to your method of poisoning, and desired no other kind. My crop is an eye-opener in this neighborhood, consequently nearly every one will poison next year. Now, as to the $50,000 offered by the State for a successful boll weevil remedy, you have earned it by a fair, honest deal, and I hope to see you get it, and I think it would be unfair not to pay it.

" 'The trouble is, George Knapp and his crowd are doing all in their power against you. Also the State Commission seems to be lending a helping hand, as we hear they are going to recommend to the next Legislature the withdrawal of the $50,000 offer for a boll weevil remedy. Fine way to do business. Offer the money, get the remedy and then withdraw the offer. However, we believe when the good people of Texas see your remedy as it is, they will demand that the money shall be paid to you as promised.

" 'I see from your communication in *Farm and Ranch* you intend raising a crop in Texas next year. I wish you could make your headquarters in Bell County. If ever I come to Louisiana on a visit, am coming to see you.

" 'Yours respectfully,

" 'J. C. HARVILLE.'

"Had the Paris Green remedy been intended to encourage the spread of the weevil instead of dstroying it, it could not have been more valliantly fought, and for what? To hold up the cultural methods, and it culminated at Houston, Texas, the other day in a grand blowout, asking the Congressmen from Louisiana and Texas to get more and bigger appropriations, and hurrah about it. The weevils, like an invading army, were spreading over the South, but they never once mentioned Gen. Paris Green! When I read those proceedings and resolutions I felt like a poor boy at a wedding. I thought I could hear the fire of the Russian ships upon the English fishing smacks, that a great catastrophe was about to happen and that a mountain had turned into a mole hill! The cry was like rattling crocodile tears upon a dry cow hide! Oh, we love the dear people, but send on the appropriations. The filthy lucre! The cohesive power of the public plunder. 'Oh, I love you, my honey, yes I do, but what about the money?'

"Gentlemen, from a long and arduous experience of thirty years in fighting crop pests, I advise Paris Green as the only remedy yet applied which offers any measure of success in solving this great question, and I would rather have the credit of having inaugurated this fight, if it comes out successfully, and I think, as I stand before high Heaven, that it will, than to have the $50,000 Texas has offered for the remedy.

"Yours truly,

"B. W. MARSTON."

The following letters and extracts were received by Captain Marston:

"Marlin, Texas, October 27, 1904.

"Capt. B. W. Marston, East Point, La.:

"Dear Sir: I beg to acknowledge receipt of your favor of the 19th instant. In reply, I beg to state that I have never met Mr. Hunter, therefore have had no opportunity to make remarks to him, as reported to you, relative to the efficacy of the Paris Green.

"Some of the Government representatives have been here, and while passing the Billingsby place, where there was some good cotton, I may have made the remark that this particular cotton had not been poisoned, and yet was a good crop. I have not had the time to examine my neighbors' crops of cotton, with the exception of one piece of cotton, where you and myself climbed the fence into the Ward place. Here were two crops, with only a wire fence between them. My darky I made poison twice, while the adjoining crop was not poisoned at all. The land is practically the same, and I know of no real difference in either of these two cuts as to conditions, but it is a fact that I have gathered two bales from my piece of cotton to one bale from the adjoining crop.

"This particular piece of cotton made me about three-quarters of a bale to the acre. I do not hesitate to say that there have been many fields of cotton over the County that have made as much, and in some instances more cotton than I have, but, then, the conditions were different, land different and other reasons for this.

"I do not like to get into any controversy over this Paris Green fight, but I honestly feel that if every one would use the

Paris Green diligently there would be no question of making a good crop of cotton in such localities where this was done.

"There is no question but that Paris Green will kill the weevil. We have eight or ten rows of cotton in our office, about fifteen feet in length. To decide this question I had the cotton poisoned. In twenty-four hours after this was done we counted at least fifty or sixty dead weevils on the stalks and leaves and squares and blooms of the cotton. This says nothing of the dead weevils that were on the ground and which we could not see.

"Personally, I feel many times repaid for the Paris Green that I used, and I intend to start early next season and use it often.

"If you want to find some Paris Green enthusiasts, write to Mr. Jess Brothers, Stranger; Andrew Glass, Rosebud, and J. B. Jones, Marlin, all of this County. They all have made even better crops than I have, and attribute their success to the use of Paris Green.

"If I can serve you further, command me freely.

"With regards, I beg to be,

"Yours truly,

"W. D. KYSER."

ENTHUSIASTIC ON POISON.

The following letter from R. H. McCampbell, at Hebbronville, has been received by Wharton & Wefing of this city:

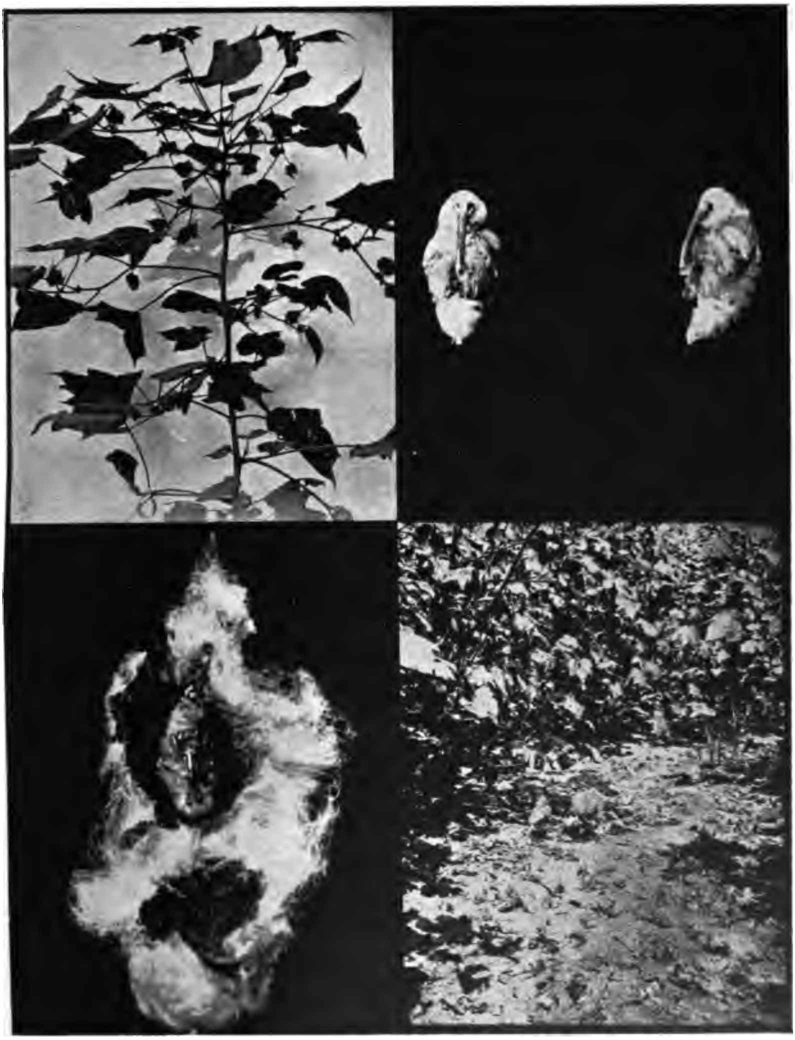
"Hebbronville, Texas, August 15, 1904.

"Messrs. Wharton & Wefing, San Antonio, Texas.

"Dear Sirs: Your favor received. Having been absent, delayed in answering. You are perfectly welcome to use my letter of previous date, and while it is an absolute fact that the boll weevil has a corner on the Texas cotton crop, the Paris Green will certainly force the weevil into bankruptcy as surely as the farmers will apply it properly and continue to do so from the early stage of the plant until picking time.

"If he will do this every eight to twelve days, according to the rain, and plows also, he will raise a better crop than ever before, and ten pounds of Paris Green will make the crop. If

Plate V.



Right Upper Figure, Infested Squares Still Hanging Upon Plant.
Left Upper Figure, Pupal Twice Natural Size.
Right Lower Figure, Pupal Cell Pupa Within Twice Natural Size.
Left Lower Figure, Fallen Squares on Ground in Field.

the up to date man does this he will get his price, and the other fellow will get nix.

"My cotton is fine and runs from open cotton to bolls of all sizes, and plenty of new blooms—all free of weevil. I have a few, but so few that it is hard to find punctured bolls or blooms, let alone the weevil.

"Insist on the boys, who have not, making experiments themselves and learn all about the weevil, as all other prudential men do, to learn their business, as the greater number who will try it properly and keep up poisoning this fall, even if only a few plants, will be convinced and will cause the merchants to bring Paris Green on in car lots and sell to them at a lower price.

"No doubt the railroad companies will be the first to offer free freight on Paris Green if they will all demonstrate the success of it, and also request the chronic grumblers and cranks to hold their bazoo while they investigate. It will be barrels of money next year to all.

"Yours very truly,
"R. H. McCAMPBELL."

BOLL WEEVIL—MARSTON'S RULES FOR POISONING THEM.

1. If possible poison before the cotton is chopped out, say two days, and poison everything in the field.

2. If poison washes off and the weevils appear again, poison again.

3. Take a hoe handle, say six feet long, and slip it into the bottom, say, of a "shot sack" made of eight-ounce osnaburgs, or any old cloth not too thin. A shot sack might be too thick. Put in, say, one pound Paris Green and tie the top of the sack (sleeve) tight around the stick as far up as it will reach, and the machine is made for poisoning one row at a time. This little cotton can be better poisoned, one row at a time, than by carrying many rows. A little stick to tap the pole as one walks along is good. Just put on enough to see a light dust falling over the cotton, say one-quarter pound per acre.

4. If it is desired to poison several rows, take a pole ten to twenty, more or less, feet, according to the width of the rows one desires to poison, and hang some sacks along on the pole above the cotton and as near to it as possible. If it touches it, it won't hurt. Then get on a gentle animal and gently tap this pole on the saddle as one rides between the rows. Two, four, six or eight rows can be poisoned at one time, but any number over six works awkwardly. As the cotton grows, shorten the strings so as to just about touch the top of the cotton.

5. Use only best Government Inspected Paris Green, or some better poison, if any is to be had. I know of none better.

6. Let water and sprays alone. It is too slow. It is impracticable. Flour, or anything to dilute it don't give satisfaction. The Paris Green is heavy and comes out first, and later on one may be putting on nothing but flour, water or the admixture. When the cotton gets larger it may take more Paris Green per acre. I have never known the judicious use of Paris Green to hurt cotton.

7. If one is afraid of Paris Green he can work to the windward and keep the poisoned cotton behind him by putting the sacks only on one end or side of the pole, keeping a weight on the other to make it balance, and poison from one to three rows instead of two to six rows.

8. Don't get your sacks wet by dew or anything, because the poison won't sift through a wet sack.

9. If the wind is bad, a box two feet long, one foot wide at top, two feet wide at bottom, can be made, open at both ends and bottom, and used as a drag over the cotton. Paris Green can be suspended on a stock through a sleeve in the top of the box in forward end, so as to touch the cotton, and it will, as it drags behind a riding cultivator, sift over the cotton. Or a double drag can be made to be drawn by one horse, with rider, and poison two rows at one time. As the cotton grows the drag can be made higher by adding planks on each side at the bottom.

10. A hay rake can be used by suspending three "sacks" (sleeves) under it, on a light pole, between the wheels, and an old piece of leather or gin band can be nailed to each end of the

pole so that it will rub the spokes of the wheels, and in this way shake the Paris Green evenly over the cotton. If wind is blowing a wagon cover can be thrown over the rake, and let it drag behind over the cotton, to protect the driver and keep the wind from scattering the poison.

The wind in Texas is the greatest setback to distributing the poison, and where failures are made they are more to be attributed to the wind than anything else. When the cotton is locked in the rows, I don't think the balance pole with sleeves on it and a screen like a cotton sheet to hold down the wind, adjusted over cotton, can be improved upon. A good hand and horse can then dust from fifty to sixty acres per day, revolving the pole and tapping it gently on the saddle as the rider proceeds.

Up to this time, July 1st, the most gratifying results are being obtained in many parts of Texas.

B. W. MARSTON,
Crop Pest Commission of Louisiana.

ADVANCED METHODS OF COTTON CULTURE.

The following is a carefully prepared report on boll weevil conditions in East Texas, written by a merchant-farmer, and containing more exact information upon the subject of cotton culture under boll weevil conditions than any recent statement appearing in the press. It is being sent broadcast over the boll weevil belt by J. H. Connell, Secretary of the Texas Cotton Section:

FAILURE AND SUCESSES WITH BOLL WEEVIL.

(S. E. Barnes.)

"It is a fact that we have in my trade territory the best crop of cotton we have had since the invasion of the boll weevil, considering the small acreage we now have in cotton, compared to what it was before. Our acreage now is not more than 40 per cent of the acreage of the years 1901-02. It is proper to say that the first weevil reached here in the Fall of 1900, but they did not clean us completely out until 1903. They did not increase on us in 1901 until we had a fair crop made, but in

1902 they got in their work earlier and we suffered about a 60 per cent loss, and together with the climatic bad season of 1903 we suffered a 90 per cent loss; in fact, about all the cotton we made here in 1903 was by those farmers whom I had induced to begin the use of improved seed and cultural methods and fighting the weevil otherwise. Am very sure that not 10 per cent of the cotton made here in 1903 was from the old style of cultivation and common run of Texas seed. The result of last year's failure convinced the great majority of the cotton farmers here that if they raised cotton at all they would have it to do along the lines we have all advocated, and the result is among my own customers. I do not have a single one but what this year has improved seed of the following varieties: King's Improved, Russell's Big Boll Prolific, Shine's. The King's stands first as the favorite and is most largely planted, the Russell's next and the Shine's last.

"The first and main thing to do under weevil conditions to insure a cotton crop is to induce your customers to plant cotton only on what are called the 'hard' or 'tight' lands of Texas, and these include many varieties of soil, such as the 'black waxies' and 'stickies,' the 'hog wallows,' 'chocolates,' 'post oaks,' 'hard prairie sandy soils,' etc. Where the loose, piney woods, sandy soils only can be obtained, the result of the crop will be extra hazardous; in fact, the only way to insure making any at all on said close, sandy soils is to fertilize the said soils freely with a good cotton fertilizer and make what little can be gotten early. For some reason unknown to me the weevil never increases to such an extent on the 'hard' soils as they do on the sandy soils, nor do they ever do the damage to cotton on the 'hard' soils that they do on the sandy, no matter what sort of a year it is. Having chosen the land to be planted, the next thing to be done is to put it in thorough condition for planting by carrying out the cultural methods we have made life weary in preaching for, the past five years. This means, of course, Fall and Winter preparation, but not Winter planting. Have the ground ready and when the time to plant comes, then plant, which in this section is best usually from March 25th to April 15th.

This year we have one test patch of ten acres, planted May 10th, which we have carefully tested with Paris Green all through, till two weeks ago, which has a fair crop of cotton on same, but that is too late to risk. If it could not be gotten in in this section by April 25th I would not plant any cotton at all that year, except small patches that could have careful treatment all through the season.

VARIETIES OF COTTON SEED.

"The next question is the seed to plant. As to that my personal preference is for the genuine King's Improved—next to that Russell's Big Boll Prolific. King's will thrive on more sorts of soils than any variety with which I am acquainted. Our best crops of it this year will run all the way from one-half bale to a bale per acre. Our best crops of Russell's will go from one-half to three-quarters bale per acre. Russell's is about ten days later than King's in maturity—maturing about same as Shine's. One advantage of Russell's is it has such a tough boll, once let it get any size, the weevil can't do anything with it, but on the contrary it has large leaves and makes so much shade and its squares after being stung have a habit of sticking on the limb, requiring some effort to remove them, all of which is to its disadvantage. On the other hand, King's has small leaves, letting in the sunshine, and its squares when stung fall off readily, and the plant itself is a most profuse fruiter when on good soil.

FERTILIZING.

"If the land to be planted is not of the first class as to fertility it must be made so by the addition of such a quantity of good cotton commercial fertilizer as will make it so. Right here will say that I don't know of any better fertilizer for the soils near me than Armour's 'King Cotton' formula. It fills the bill exactly here, but I presume other manufacturers make equally as good goods. The idea is this; you must have a fertilizer that will make the stalks fruit rapidly and quickly, and the formula above named will do that. Perhaps there is very little land in Texas that would not make weed enough, but under weevil conditions we want not only something that will hurry the weed a little, but will hasten the fruitage of the plant.

"One other important thing I wish to call your attention to is that the first year Texas growth of King's North Carolina Improved Seed will make a larger stalk, fruit heavier, make larger bolls than the imported seed. Planted side by side, the fresh North Carolina and one-year-old Texas, the Texas grown showed open bolls in 103 days from planting, while the North Carolina Improved showed in about 113 days.

"Another thing in choosing planting seed is to bear in mind that ten days on a cotton crop often means success or failure, and act accordingly.

"Now as to the most frequent charge against the King cotton that it is a four lock, small boll cotton, and that it takes too many of them to make a pound. My answer to that is this: When you plant King's cotton on 'hard' lands of the requisite natural fertility, or if not so naturally, fertilize it as suggested until it is brought up to the requirements, if the result is not that a majority of the bolls grown are not good five-lock bolls and the balance good sized four-lock bolls, then I will be willing to eat the patch. If the attempt is made to grow this or any other variety on poor, loose, piney woods soil, I want it distinctly understood that I won't undertake any such diet.

CHECKING AND POISONING.

"In planting the cotton I would advise that it all be checked in order that the plants may have the proper distance apart, for after all is said, cotton can not be made without plenty of sunshine, hot sunshine, that will reach to the ground till the cotton opens.

"The next thing to be done after the cotton is up and has formed a bud with two or three leaves, I woud begin the application of Paris Green and treat it every eight or ten days till about July 15th, by which time the weed will be so large and will have so many buds on it that it will not after that pay to apply it. By then one should have a fair crop assured if he has followed the methods suggested herein. The cotton, of course, must have the best cultural attention from time it is planted till it opens. In case of rainy spells setting in and interfering with application of

Paris Green, in such cases we resort to the picking and burning such fallen and flared squares as appear, which with us this year, although very favorable for the weevil on our most carefully poisoned crops, have not given us much extra work in that line to do—nothing at all compared to what those had to do who relied on their success entirely on picking and burning fallen and flared squares. We have, of course, those who can not be induced to use 'pizen'—even to 'pizen' leaf worms after all these years—but the most of my folks don't have any conscientious scruples in that respect.

"You understand I do not advocate the use of Paris Green as a certain specific, but do value it as one of the best and surest remedies yet devised in the fight. The nature of the weevil is to feed in the buds of the cotton plant from the time it has a bud in the early Spring until the plant is killed by frost in the Fall, or until such time as the weevil leaves the plant to go into its Winter hibernation. Now, when the plant is young and with only one bud, it is comparatively an easy matter to kill practically all of the weevils as they come into those buds to feed, but as the plant takes on more buds the difficulty increases in proportion as the size of the plant and its number of buds increases. Another thing, the weevils do not all leave their Winter hibernation quarters at once, but they spread this over a period of two months, to the best of my knowledge on the subject. As soon as the squares form they alternate between the buds and squares and when the blooms appear they enter them in the morning, the same as honey bees, for the purpose of seeking the nectar therein and the female weevil will send her sting right down through the lower part of the bloom and deposit her eggs right in or on the tender embryo boll, and in a few days it will either fall off, or if it grows it will be lopsided.

"That the weevil can be killed in the blooms, also, a friend of mine here (R. F. Herndon) has thoroughly demonstrated. He has hunted out many hundreds of the weevils in the blooms of the cotton during this season, and has dusted a little Paris Green in them and tagged the bloom and watched the effects, and almost invariably the weevil would die in two hours' time—

rarely ever going three hours, and comparatively few disappear. Seven out of thirty-four being the greatest number he could not find for one summer's work—the balance, twenty-seven, being dead in the bloom. The effect of the Paris Green on these blooms could not definitely be told from the non-poisoned ones—about the same number of each being cast off by the plant. The main thing about this weevil invasion is the resulting loss of confidence on the part of the farmer at all, but once show him that the thing can be done and you will gradually wean him over to the new methods and conditions and the first thing you know they will begin to try a few acres of cotton, raise a bale or two and get good prices for it, and then more hopeful times come in sight. Almost from the depths of destruction and despair, financially, our immediate cotton farmers will this fall be in fairly good shape again with good heart and hopes for the future.

"It is along the lines outlined they have had their success; and what this community has done others can do along similar lines. I only mention the experiment of poisoning weevils in the blooms as being of interest in showing that the weevil can be poisoned, both there and in the buds of the cotton plant, indicating that with a more perfect method of application great results may yet be obtained with dry poisoning. If I can be of further assistance, command me.

"Trinity, Trinity County, Texas."

Convention adjourned at 10:15 to meet at 9 o'clock the following morning.

SECOND DAY.

MORNING SESSION.

President Schuler called the convention to order at 9:30 o'clock.

The first thing on the program was the discussion of Captain Marston's paper, which was read the night before. By request Dr. W. D. Hunter, in charge of the boll weevil investigations, discussed the paper. He said:

"Captain Marston went to Texas on his own responsibility; something was said about paying his expenses, but he stated that he preferred to pay them himself. As for the $50,000 reward offered by Texas, I would like very much to see Captain Marston receive that reward. If it can be demonstrated that Paris Green will destroy the boll weevil, as claimed by Captain Marston, I would like to see an appropriation of a million made and given to him.

"In our investigations in Texas, we do not consider that we know all there is to be known about the boll weevil. There are many things known, but other points are coming up constantly that need to be investigated. The more men and the more minds interested in this subject, more satisfactory results will follow. Therefore, I am glad that Captain Marston has taken the interest he has. I think it would be a good thing if there were more men like Captain Marston who would look into the proposition as he has.

"However, it must be stated that Paris Green is not a new remedy. Another point is, the boll weevil does not feed on any plant except cotton. Numerous experiments have been made that demonstrates beyond question that they feed and breed on cotton squares alone. Therefore, the Captain is mistaken when he said they fed upon figs, watermelons, peaches and other fruits. We collected such plants as are related to cotton and endeavored to keep the boll weevil on them, but so far we have not succeeded in getting them to breed on anything but cotton.

"When Winter comes, the boll weevil goes into quiet hibernation and remains there until Spring. Captain Marston stated that he placed some in a phial and that they died in from seven to ten days, and concluded they died of starvation. I suppose Captain Marston will allow me to say that he is theoretical."

Captain Marston—I said that when the weevil came out of hibernation when he was found on the cotton plant, I found only what had lived over seven days.

Dr. Hunter—Did you not say that weevils must feed on something during the winter?

Captain Marston—No, sir. It is a fact that all over Texas the weevils came out and were found flying all over the country.

Dr. Hunter—Well, I am glad to know we are closer together than I thought.

"In the Spring these weevils come out and feed on the open buds and leaves. At the time that Captain Marston came to Texas and made his experiments, only about 1 per cent of the hibernated boll weevils were out. They come out from the 1st of February until June the 1st. Ninety per cent of them do not come out until the cotton has begun to square. They feed on nothing but the leaves and squares. Nature has formed the square in such a manner that it prevents anything from getting in and injuring the fruit, so Paris Green can not get into the squares and thus destroy the weevil by spraying. Paris Green will, of course, kill the weevil when applied to it, but the question is, How can it reach them?

"A large portion of time is spent in the laboratory experimenting with poisons. Consequently, when this Paris Green attracted attention in Texas, we tried a long series of experiments on our farm at Victoria. We applied Paris Green according to Captain Marston's recipe, as given in the *Texas Farm and Ranch,* but without any satisfactory results. We continued to use it until we used as much as fifty-three pounds of Paris Green to the acre."

Mr. Stringfellow asks:

"How tall was the cotton when you applied the Paris Green?"

"It was volunteer cotton; it had begun to square. We concluded to carry the matter to further demonstration. We set aside special lots in which to follow Captain Marston's directions of poisoning the boll weevil with Paris Green. Plants were carefully examined to find the number of weevils and this indicated on tags, and papers were spread in under the plants to catch the dead weevils. In spite of this, during a series of tests 40 per cent of the weevils were missing. As soon as it was found that a large per cent of weevils were missing, weevils marked with red and blue pencils were used, and nearly 10 per cent of those missing in the tests with marked weevils were subsequently found on other plants. A series of careful tests have shown that weevils eating Paris Green are unable to fly. From this it must be concluded that nearly all the missing escaped alive.

"We made several tests at Victoria with dry Paris Green in which 752 weevils were used, average time elapsed to last examination, fifty-four hours; average weevils found alive, 27.12 per cent; average weevils found dead, 32.05; average missing, 40.89 per cent.

"As stated before, most of the weevils undoubtedly escaped alive, so that the number actually found dead represents merely the whole number killed. The period of emergence of the weevils from hibernating quarters is known to extend over more than six weeks, so that at least four applications of poisons would be necessary to keep the cotton poisoned thoroughly enough to kill as many weevils as were killed in the above tests. The lightest application was twenty pounds per acre, and four applications at this rate would not be profitable, especially since the last application would be after the cotton had squares on it and the number of weevils the poison would kill would be greatly reduced. No tests were made with very light applications, but the following experiments, both on the Government farm, show the inefficiency of Paris Green where the poison is applied at the rate of one and one-half to three pounds per acre for each application and used throughout the season:

"At San Antonio an isolated spot of about three and one-half acres was chosen, there being cotton only on one side and separated from the test fields by a dense strip of sorghum. Half was kept on a check, and beginning where the first squares were formed, Paris Green was applied to the other half by means of a sack on the following dates:

"June 10th, one pound per acre.

"June 16th, one and one-fourth pounds per acre.

"June 24th, one and one-fourth pounds per acre.

"July 5th, one and one-fourth pounds per acre.

"July 15th, one and one-fourth pounds per acre.

"August 1st, one and one-fourth pounds per acre.

"From July 13th to August 3rd, examinations were made to ascertain the relative number of squares infested on the poisoned plot and its checks. Blooming had stopped before the first examination, and practically the same time on both plots, so the table does not show the relative infestation while blooming was in progress, but it does show most conclusively that the poison did not kill enough weevils to allow the field to keep on blooming and producing bolls after the check had stopped blooming.

"Average of squares infested during all examinations on Paris Green plots, 89.94 per cent; on check, 89.53 per cent. The fact that the percentage is almost identical shows that the poison had practically no effect.

"Captain Marston tells how he went to Houston and performed his experiment with the weevils in a phial, in which he put some Paris Green, and in a certain length of time found all the weevils dead. If Captain Marston had put some kind of water in the same phial with the weevils, he would have found the same result. They died of exhaustion. This shows that we must use the checks—check those treated by the poison and those not treated, and arrive at definite results. There is entirely too much jumping at conclusions.

"There is this difference in the cotton crops of Texas and those of Louisiana. In Louisiana they run more uniform and regular, while in Texas they are 'spotted.' One crop where there is no apparent reason for the conditions will show a good crop on part of the field, while the rest will have nothing. Should the part which has a good crop have been poisoned, the owner very naturally concludes that the poison was very effective, but as happened in several instances, a number of the fields with poor crops had been poisoned and did not produce anything, while the non-poisoned portion of the field produced a very good crop. In many instances the farmer has taken no precaution to have an adequate check on his poisoned area, and has come to the conclusion that the field to which he has applied poison is much better than that portion which he did not poison. Whereas, his neighbor, who has not used any poison at all, has as good, if not better crop than the man who used the poison.

"When the weevils come out in the Spring after long hibernation, many die from exhaustion. One farmer decided to try poisoning. He applied his poison one day and the next day went out and found a number of dead weevils under the plant, but he also found as many dead under plants that had not been poisoned as those that had been. Had he been a less careful man and failed to observe the result under non-poisoned plants, he would have concluded that the poison had done the work.

"In conclusion I might say that we have watched this Paris Green carefully. The fact that Paris Green would kill a certain per cent of weevils has been known to the agents of the Bureau of Entomology for a number of years, and was suggested as a spray as early as 1895 and repeated in 1897. It was, however, recommended only as a means of killing off some of the hibernated weevils before squares appeared on the cotton.

"I have taken pains to send inquiries to all the so-called Marston's experiment farms, the fields at Lockhart, Cuero, Marlin, and all they could say was that Paris Green had not produced cotton in Texas. We can not recommend Paris Green."

Mr. Herndon, of Caddo, asks:

"How do you account for the dead weevils?"

"Long hibernation."

Captain Marston arose to defend his theory. He said:

"Gentlemen, Dr. Hunter has made some extraordinary statements. He said that from experiments the boll weevil was found to feed on the cotton squares only. If you will read through Mr. Barnes' letter, which I read here last night, in which he testifies that all through the year he finds boll weevils feeding on the buds of cotton.

"They not only feed on the bud; I have gone with my lantern at the hour of midnight and seen them feeding on the honeydew of the cotton, then tell me you can not reach them under such conditions!

"He also said something about finding dead weevils elsewhere than where they had been poisoned. I never found a dead boll weevil anywhere except where cotton had been poisoned. I never found a live one where I had poisoned the cotton. You can't go through the fields after I have poisoned them and find a live boll weevil, while you can go into the fields adjoining and find thousands of them. I have found dead weevils inside the square of cotton that I had poisoned. I do not know whether he ate the poison and then crawled into the square to die, but I have found them dead inside the square. And I defy anyone to find a single live boll weevil in a field where I have poisoned. Cotton in those fields made from half to three-fourths of a bale to the acre.

"At Lockhart there was a field of cotton divided by a sorghum patch. I did not know that there was cotton planted on the other side of the sorghum. On the side to which I applied the poison, there was not a live weevil to be found, while on the other side of the sorghum I was astonished to find it alive with weevils. The cotton I poisoned made double the amount on the other side, where it was not poisoned. This will be testified to by the citizens of Lockhart.

"With such proofs before you, gentlemen, can you stand by—can you take the statements of men whose desire is to encourage the boll weevil instead of destroy him? I am not here to make war upon anybody, nor their methods. I say, give me the best cultural methods. Come to my place on Red River and I can show you cotton that made a bale and a half to the acre, which a few years ago the land on which it was made was so poor that it amounted to nothing. I am a cultural system man, but I defy anyone to show me where the cultural system has ever gotten rid of the boll weevil."

To these remarks Dr. Knapp replied:

"When I came to this convention, I did not intend to make any speech upon poisoning, but it seems to have been forced upon me. We have to defend ourselves, as I learn that Captain Marston made some references to me, or to George Knapp, whoever he is—I have heard of him, but have never met him.

"As far as I am concerned, I should be exceedingly glad to have it proved that Paris Green is a remedy for the boll weevil. Early last Spring, before Captain Marston went to Texas to remain, I issued 3,000 circulars, requesting the people to poison their volunteer cotton."

Captain Marston interrupted by saying:

"Those circulars were dated the 15th of April, while I made my visit on the 9th day of April."

Dr. Knapp replied: "I said they were published before you went to Texas to remain. You may have made a visit there. I speak from positive facts. These circulars were prepared and marked ready to be sent out——"

Continuing his remarks to the convention, Dr. Knapp said: "I believed it would be possible, as Dr. Howard also thought, to poison the boll weevil on the young cotton. Later it was found impossible.

"As far as I can learn there is but a very small fractional percentage of farmers who believe in the use of Paris Green. I recollect only one man who reports that he has used this Paris Green remedy effectively. There will not be one-tenth as many who will poison next year as in the year past. That is their experience—I am not saying what is their judgment. Some report that they poisoned their cotton five times and could not see any difference in the cotton that had been poisoned five times and that which had not been poisoned at all. I should be glad to have Captain Marston, or any one else, be sucessful in finding a remedy which will be effective in destroying the boll weevil. It is a cold fact—Does Paris Green destroy the boll weevil? or, Does it not? I say it does not, and I can prove it.

"I sent men to every field in Texas that Captain Marston has poisoned. Their report was, which I have in my office, 'We find any quantity of weevils in the fields that have previously been poisoned by Marston,' notwithstanding Captain Marston says no weevils can be found in the fields poisoned by him. Some men made better crops than others—whether that was due to cultural method or to poisoning, I can not say. I am not trying to prejudice you. You poison—you do it at your own expense. I am simply stating facts as I find them."

"Poisoning after the cotton begins to put on squares is not worth a rot. The Captain is mistaken, and it can be proved, that it is not worth anything, so far as Texas is concerned. If it can be proved that it is all right, then I am ready to clap my hands. We have no theory. We have the statements of hundreds of men who say this plan of the Captain's is all a theory. But we can not accept a theory until it is proven. Prove your theory and we are for it, but we are not in favor of such expensive methods until they are demonstrated.

"Captain Marston said that the cultural system was a makeshift and did not kill the boll weevil. We have found by experiments that by having the rows wide apart, so the sun can get in, destroys weevils by the million. The larvæ is killed by the sun. In our office we have a thousand letters from men, stating that 95 per cent of the squares where they were exposed to the sunshine were killed. I am in favor of killing the boll weevil in the Fall, and am not in favor of attempting to poison him on volunteer cotton in the Spring."

Captain Marston—I have a letter from the Rev. Purcell, a Presbyterian minister, of Lockhart, Texas, which is on file in the Crop Pest Commission's office here, which I wish brought here and read to this audience, which will contradict every word this gentleman has said.

Dr. Knapp—And I will file before this body a hundred letters substantiating what I have said.

President Schuler—We can not bring the letters before the convention, and this question has been discussed sufficiently, and we have a program which must be taken up, so we will continue with the program.

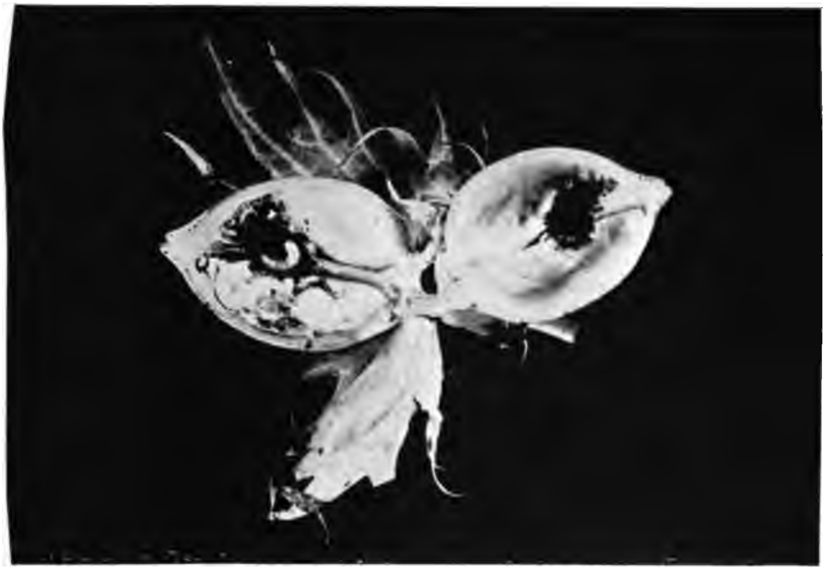
Mr. Herndon says: "I will be one of ten, or as many who will go, who will pay our own expenses, and go to Lockhart and investigate this question. This is a matter of importance, and we desire to know the facts in the case."

Mr. Stanley Watson, of Houston, Texas, representing the interests of the Houston & Texas Central Railway Company, said:

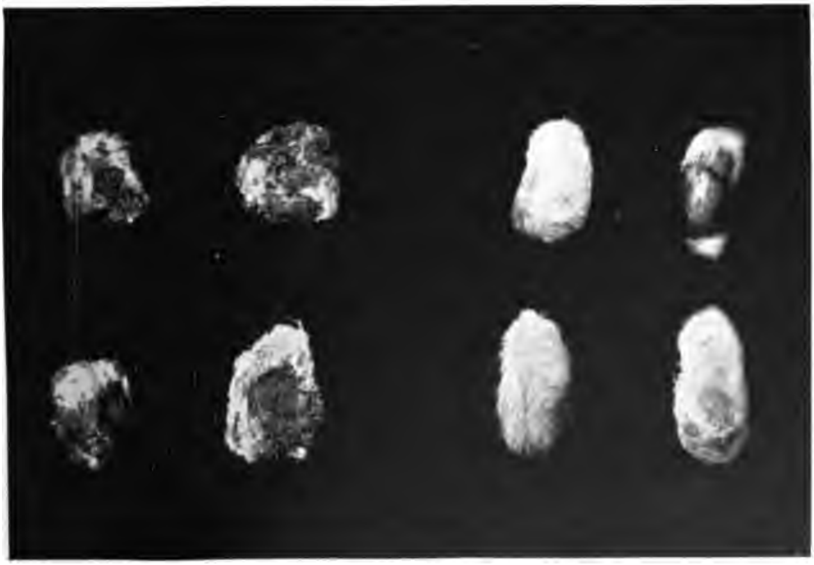
"Gentlemen, the trip won't cost you a cent. We will furnish transportation for as many as wish to go."

Hon. W. L. Foster, Chairman of the Committee on Resolutions, recommended the adoption of the following resolution, which has been presented by Capt. E. Johnson, of Memphis:

"WHEREAS, It is evident that the cotton boll weevil is mi-



Large and Small Larvae in Bolls—2-3 Natural Size.



Four Pupal Cells From Bolls (on Left) Compared With Four Cotton Seeds (on Right) Natural Size.

grating, and it is only a question of a short time when the whole cotton States of the country may be infested, and

"WHEREAS, It is necessary not only for the planter, but the merchant, banker and factor, to get together to carry out immediately a plan to protect their interests and the interests of the whole world; be it

"*Resolved,* That a committee of fifteen be appointed at once to present to this convention a feasible plan whereby delegates from all the cotton growing States, factors, merchants and bankers in said States, can be called together in a general convention, to be held in this city, at as early date as possible."

Mr. W. H. Ogden moved the adoption of the resolution, saying:

"This interest is common to us all, and a meeting of delegates from all the cotton growing States will, I believe, result in much benefit to us all."

Some one in the convention suggested New Orleans as the place, saying:

"New Orleans is more able to take care of such a crowd as will attend this convention. It has more commodious hotel accommodations, and is equally interested in the question, and I think better able to entertain the crowd."

A number protested against New Orleans and urged Shreveport.

Mr. Spillman said: "While I have the kindliest feeling for Shreveport, I do not believe that the hotel accommodations here are such as could entertain such a large gathering. I, therefore, suggest that the place for holding the convention be, for the present, left open."

Colonel Ogden said:

"Shreveport is the center of the boll weevil district and is the proper place to hold the congress. Another thing, Shreveport was the Capital of the Confederacy. I will guarantee that Shreveport will accommodate the crowd and all doors will be thrown open free, if it becomes necessary. Shreveport is hospitable and has ample accommodations."

Hon. W. L. Foster said:

"Some eight to twelve years ago the State Democratic Convention was held in Shreveport, and the hotel accommodations were not then what they are today, and I believe that Shreveport is thoroughly able to take care of the crowd."

Mr. Sherman, of North Carolina, was opposed to the resolution, saying:

"If the convention is held over in this corner of the cotton growing States, only those around here will attend. I do not think my State would send any representatives this far. This is a question that all the Southern States—the cotton growing States—are equally interested in, and I am in favor of holding the convention in a more centrally located point. But at any rate we have assisted you in that we have sold you the seed."

To which Mr. Connell, of Texas, replied:

"I shouldn't be surprised if some of you cotton seed dealers attend the convention, whether it is held in Shreveport or elsewhere."

Col. F. L. Maxwell was in favor of New Orleans or Memphis, believing that Shreveport was not able to accommodate the crowd.

Mr. Howard Stringfellow said:

"Why, we can handle them all right. Didn't we take care of 15,000 people at the circus the other day?"

Captain Johnson, of Memphis, who offered the resolution, stated:

"I selected Shreveport as the place of meeting because it is the third largest cotton center in the world, and it is centrally located in the boll weevil district, and I consider it the very place for the meeting."

The resolution was unanimously adopted, and President Schuler appointed the following committee:

Capt. E. Johnson, Memphis; J. H. Connell, Dallas; H. C. Stringfellow, J. C. Pugh, John T. Watkins, Alfonse Prudhomme; Stanley Watson, Houston; John A. Skannal, Shreveport; A. F. Jackson, DeSoto; W. E. Glassell; Prof. Franklin Sherman, North Carolina; P. P. Keith, Caddo; H. A. Morgan, N. T. Blackwell; and Charles Schuler, of DeSoto.

W. J. Spillman, of the United States Agricultural Department at Washington, delivered an address on the "Diversification of Crops in Louisiana," as follows:

"*Mr. Chairman and Gentlemen:*

"At the instance of a Congressman from Texas and members from other cotton growing States, Congress appropriated $250,000, not for the purpose of destroying the boll weevil, as the public seem to think. It was not for that purpose the appropriation was made. It was made to deal with the situation caused by the advent of the boll weevil. That was the intention of Congress in making that appropriation. There is no one so sanguine, I don't suppose, as to hope that the boll weevil will be exterminated. I wish methods might be found by which it could be exterminated.

"The money which Congress appropriated is not being wasted, but is being used most carefully in a number of ways to deal with the situation caused by the advent of the boll weevil. In the first place, a portion of it was turned over to the Bureau of Entomology. This Department has men working in co-operation with various State experiment stations. Dr. Hunter here has charge of a station in Texas, and co-operates with Professor Morgan of this State dealing with the boll weevil. The entomologists are investigating the weevil and its habits. As a layman, I claim the privilege of heartily endorsing the work of Dr. Hunter. He gathers boll weevils at different times of the year. He gathers them in the Fall and keeps them over Winter. He finds that those gathered in September die before Spring; in December, some live through the Winter. One of the most important points is to destroy all vestiges of the cotton crop by the 1st of October. The weevil is hatched only in the square of the boll, and if there are no bolls or squares at that time, no weevils will be hatched. Weevils hatched after that time do not live through the Winter. I hope that by next season the farmers will have destroyed their crops at the proper time and thus destroy the weevils—if we find that by destroying the cotton crop by the 1st of October destroys the weevils.

"Another line of work that is being done by the boll weevil experts is to study the habits of insects.

"Still another line of work that this appropriation is being expended on is in assisting the farmers all over the country in using better, methods. In the 200 years that we have been growing cotton, some very fine methods have been used. We have an example, in Georgia, I believe, of four bales to the acre having been made. I know of men myself who produced two bales to the acre. So a portion of the appropriation was turned over to Dr. Knapp to help the farmer who does not use these methods.

"One of the most important points in connection with the cotton crop, in addition to those already spoken of, is the destruction of the crop in the Fall. I spent two months this Summer traveling through Texas. On Mr. ———'s farm, near Mart, on which he had fifteen acres of King cotton and eighteen acres of Mayden, planted on the same date. I was there the first week in August, and he had gathered half a bale to the acre off the King cotton, and his judgment was there was more than a quarter in sight ready to be picked. While on the Mayden it would take ten acres to make a bale."

Captain Marston interrupted, saying:

"I think you are mistaken. The Mayden was not destroyed and the King was."

Mr. Spillman continued:

"The field I was in was said not to have been poisoned at all. However, I went to a small patch of cotton in Lockhart that was said to have been poisoned three times by Captain Marston, and the boll weevil was as bad in that as any place I ever saw. Every square had boll weevils on it, and while I did not make such a very careful search, but in the ten minutes looking over the field or patch in a scattering way, I was not able to find a single bloom during the ten minutes.

"The boll weevil has come to remain, and he is the best friend the Southern planter ever had.

"Another feature of the work being carried on is in producing early varieties of cotton. They are investigating methods to overcome rust and root-rot. Why, there are some places where root-rot is more serious than the boll weevil. There are instances of where 90 per cent of the crop was destroyed by root-rot. Those are different lines of work that are being used.

"The boll weevil is the greatest blessing that has ever come to the South—it is the friend of the Southern farmer, and I am here as the ally of the boll weevil.

"There has never been a system of agriculture in the world that was based on a sigle crop that did not lead to disaster, I care not how valuable the crop is.

"Out on the Pacific Coast, as rich as any land, I have seen hundreds of counties planted in hops, and I have seen, too, after the harvest every bank go 'busted.' Banks change hands there about every three years. I contend that a system of agriculture that causes a man to lose everything he has, is an unwise and an unsafe system.

"In 1894 I had the position of Professor of Agriculture in the State of Washington, one of the richest wheat sections in the world. I made sixty bushels of wheat to the acre—that was a wheat country—twelve years ago. 'Twas a beautiful sight to see miles and miles of the golden grain, and the farmer's heart swelled with pride as he looked it over. In that country there were no poor farmers—there were no poor people in 1892. Up to 1894 no crop was planted there but wheat. That was the system of agriculture. The country was on a boom and all the farmers were prosperous. They were making from $45.00 to $50.00 per acre on wheat. They were getting rich and retiring from business. As they would retire, others would come in to take the place. In 1893 there wasn't one farmer in fifty who wasn't after more land to grow more wheat. In that country the rain comes only in the Winter. In the Fall of 1893 the Fall rain began in September, and there wasn't a farmer in Whitman County who had his grain in his warehouse when the rain began, and it was the last wheat harvested that year. Things began to get shaky. In 1894 we had a panic. No. 1 wheat sold for 18 cents per bushel, and it cost them 85 cts. per bushel to grow wheat. In 1895 the price raised to 25 cents per bushel. But loss was inevitable.

Failures were everywhere. Merchants closed their doors; banks went 'busted.' That is what wheat growing did.

"I preached to them to diversify their crops—to raise grass, to raise cattle and hogs.

"Three years ago I went back to that country and found as fine short-horned cattle as can be found in any section, and today it is one of the most prosperous parts of the United States. They continue to raise wheat year after year, and it is still the principal porduct of that country. This is so applicable to conditions here in this Southland.

"A hundred years ago, or more, some planters reclaimed a lot of land from the Atlantic Ocean. The land was reclaimed at great expense, but they found they could raise indigo and rice. For over seventy years no other crops were planted but indigo and rice along this strip of the Atlantic. These planters amassed enormous wealth. The rice growers of South Carolina were lordly men. Their homes were palatial and they lived a life of ease and luxury. Thirty years ago, a chemist got to nosing around in his laboratory and discovered how to make indigo cheaper than those men could grow it. But they still had their rice to live on. For fifteen or eighteen years they continued to make money on rice. Now, here comes Dr. Knapp and has taught the farmer how to produce the rice with machinery. Down here on the coast a man can grow twice the rice that they can on the Atlantic coast.

"My remedy for all disease is—*Grass!* The day I left Washington I sent a young man to South Carolina to grow grass. I am going to try it on the rice fields of South Carolina.

"I wish to show the importance of following a system of agriculture which has a solid foundation.

"What about cotton—it has been the mainstay of agriculture in the South for a hundred years. Does it pay? Do the prices ever go down? Has it worn out the land? Has it made the South rich? It is the worst old tyrant. Do you know what the average farmer's income is today? Let me tell you. We will say the average renting farmer's family consists of five members, about three of these are working hands. Well, he takes about thirty acres of land. Of that thirty, he puts about twenty in cotton and ten in corn. I am speaking of the average renting farmer, you remember. He gets about six bales of cotton off the twenty acres. From his corn crop he gets about enough to feed his mules and make his corn bread. One-half of these six bales of cotton goes to the owner of the land for rent, so he has left three bales of cotton for the year. In the cotton growing section they use fertilizer on cotton, so at 10 cents per pound for cotton he would have $150.00 for his three bales, and out of that he would have to pay for his fertilizer. This will leave him $40.00, or $3.25 per month, or 12½ cents per day. That is, he will have this income with cotton at 10 cents per pound, and you can estimate what it is at 8 cents, which has been the price for several years until last year. Cotton is a tyrant that has enslaved the laboring people of the South. I want to say to the farmers of the Southern country, adopt a system of agriculture which will bring wealth to your farms, to your cities and make your States a great commonwealth. Go back to the hills of South Carolina and Georgia, where cotton has been grown for the last hundred and fifty or two hundred years, where they have one crop a year, reduce the income above given you two-thirds, and you have the income of the farmers from cotton.

"I wish to preach diversity of farming. Reduce your cotton crop and plant some of your land in something else and realize three times as much per acre as you do now. I do not believe I could make any headway in this doctrine had it not been for the boll weevil.

"The boll weevils have brought many hardships on the people of the South, and I sympathize and feel keenly their sufferings. There are parts of Texas in which people have starved as a result of the boll weevil. But why is this? It is simply because the South has based its prosperity on a single crop. If cotton occupied the place that it should, the boll weevil would be an insignificant thing. I am of the opinion that any system of agriculture which is based on a single crop will lead to ruin sooner or later. Then let us build here in the South a system of agriculture that will make the South richer than the

North. You have the climate, the soil and the people with courage to do it. But how are they to be made to believe that?

"The Secretary of Agriculture of the United States asks each man to outline his work. Every one looks at the problem from his own standpoint. When I was asked to suggest what line of work I considered would be most beneficial to the South, I replied, 'Diversify the agriculture of the South.' I said, 'Let us establish thirty improved, model farms in the South, and make these farms more profitable than any cotton farm in the South. Have them run by Southern farmers, and let us assist in advice all that we can. Let us help them plant their crops. Give them information as to how many crops to plant, when and how to plant them. Help them by telling and showing what others have done.' This plan was approved, and we are today running twenty-six of those farms. We have one at Natchitoches; one at Atlanta, one at Marshall, one at Lockhart, etc. We have thirteen of these farms in Texas and are ready to build four more in Louisiana, if they want them."

Mr. Spillman was interrupted with calls from all over the house for the location of model farms at different places in Louisiana. He replied:

"We are ready to build four any place they are wanted—the only thing, we would like them scattered about over different parts of the State.

"We have three model farms in Mississippi. In connection with this work, you have four experiment stations in this state. These farms that I speak of are not experiment stations. We take the information gleaned by investigation of others, we take what information we can get from them and with our own we put it to work on these farms for the purpose of making money, and as soon as the farm is in running order we invite people to inspect it and show them over the farm. We call these diversification farms. We are going to ask Congress to assist us in establishing 100 of these farms next year.

"At Uniontown, Alabama, seventy years ago, they raised two and one-half bales of cotton to the acre. What did cotton do for that land. It wore it out. For the last few years they have been raising a third of a bale to the acre. We built a diversification farm there, raised live stock, had a truck farm, etc. Last Spring we had 102 hogs ready to sell and the proceeds from the farm were enough to convince any wise farmer that cotton was not the most paying crop of the South. I know that a man can make more money out of live stock and diversified farming than he can on cotton.

"I am here to make suggestions that will be helpful to you and not to hinder you. I want you to grow cotton, but grow it in a sensible way. We need your cotton. Grow more cotton than you do now, but grow it on less land. There are some people who would have you grow only cotton, but these people are not your friends. I have for the past three years devoted my time in the interest of diversification of crops in the South, and, God allowing me, I intend to devote the next thirty years to the South.

"Colonel Smith, over here at Sherman, Texas, has over a thousand acres in alfalfa and is getting rich. There is much land in this State that would bring more money planted in alfalfa than in cotton.

"The first time I went to Texas I visited a young man who had become a planter there. He was getting his 9 cents per day, that is the average of the renting farmer. I said to him, 'You are a smart, sensible man—why do you not grow some sorghum, some peas, corn, oats, etc.? You can grow all those on the same land and make three times what you are now making.' He said, 'Well, I don't know how.' I gave him some suggestions and assisted him in planning his crop. A year later I went back there and he had four good cows—four splendid cows, and he was making more money off those four cows than he had on cotton. Later I found him reading literature on agriculture. He now has an income of $110.00 per month. Last year I found him with ninety cows of the finest in the country. He has one of the best dairy farms and is making money fast. Says he receives $41.00 per acre for every acre he has.

"In Philadelphia there was a man who inherited thirteen acres of land in the edge of town, with a $7,200.00 mortgage on it. He had never done any farming in his life. He got a dairy paper and decided he would try dairy farming. In six years he paid off the mortgage. You people can do better than that. You can grow three crops per year, while the Northern man can grow only one. The South is better adapted to live stock farming than the North. You can get Chicago prices, plus the freight. Your Bermuda grass will support two cows to the acre, while it takes two acres for one cow in the blue grass. You can grow six to ten tons of hay to the acre. The day is not far distant when the South can set pace for the cattle industry of the North.

"I am not arguing against cotton, but I want you to grow it in a more rational manner. Grow more cotton on less ground. Enrich that ground with barnyard manure. I have never used commercial fertilizer.

"Last year the truck farmers of the South got three and a half million dollars—I do not know what the commission man got, but that is what the farmers got. One farmer harvested his crop of onions that sold for between eight and nine hundred dollars per acre for the year. Two boys over here in Texas borrowed $6,000 as a capital to operate on. They planted onions. In the Spring they paid back the $6,000 and had $21,000 to their credit.

"I hope to see within the next ten years a system of agriculture that is diversified; better farm implements; better schools for the children. I hope to be able to ride through the South and see little children on their way to school—to nice public schools—instead of crawling on their knees picking cotton. Gentlemen, I am opposed to any industry that must live on human blood. Put something in the place of it that will promote the laboring man.

"I think that it would be a calamity to the South to kill the boll weevil until a solid system of agriculture had been decided upon. The boll weevil is my strongest argument for diversification of crops, and I do not want him poisoned now. After a system of agriculture has been arranged, then I would not care if Captain Marston killed every one of the boll weevils."

Mr. W. W. Sebastian, of Caddo, moved that a vote of thanks be extended Mr. Spillman for his able address. The motion was carried by a rising vote.

Maj. J. G. Lee, Commissioner of Agriculture of Louisiana, delivered an address on "Diversification of Crops in Louisiana."

Major Lee spoke as follows:

"*Mr. President and Gentlemen of the Convention:*

"Diversification of crops is the only rational farming system. For a time and under favorable conditions and circumstances a special or one crop system may and does succeed, but in the long run, and under varying and trying conditions the diversified system is the safer and wiser practice. More than one circumstance, within our own State and of our personal observation and knowledge may be referred to, in substantiation of this affirmation. For a number of years our great rice belt, Southwest Louisiana, has enjoyed the honorable distinction of being regarded as the most prosperous section of our prosperous State. Twenty years ago lands there were purchasable at 75 cents and $1.00 per acre. The raising of one crop, rice, upon new land and under economical soil and irrigation conditions has brought immigration, development and prosperity to that entire section. The example and object lesson there taught has been a hope and an inspiration to all the people of our State. In that hitherto sparsely settled country towns and cities have sprung up like magic. Land values have increased to $25.00, $50.00 and even $100.00 per acre, assessments have doubled and trebled, and consequent prosperity is the result. The one crop, rice, is responsible for this happy condition of things, and yet it may happen that the practice of that one crop system to the exclusion of a diversified system will retard the splendid progress of that fair section of our State. For we are told that the rice industry is now somewhat depressed and that its outlook is not altogether promising, because of restricted markets, lower prices, reduced acreage yields, etc.

"Formerly it was the custom our our farmers to raise cotton to the practical exclusion of food crops for the farmer's support.

Cotton was the sole money crop and dependence, upon which the farmer relied for money to pay all debts against the farm, and for family support. Similar to rice, it was like carrying our 'eggs to market in one basket.' If by chance no mishap befell the basket en route and the market was safely reached, it was well and good. On the other hand if any accident happened, the trip to market was wrong and profitless, only adding to our discomfort and contributing largely to our ultimate undoing in the continuous planting of cotton or other crops upon the same land, year in and year out, without rest, without rotation, and the use of restorative crops, and fertilizers, brought partial depletion to our most fertile soils and consequent reduced acreage yields, to such an extent that it has become the serious concern of economists, scientists and statesmen of both State and Nation. The world is crying out for our great staple, cotton is still 'king,' and yet so good and royal a king can clothe but scantily many of the millions of the world's population.

"The growing scarcity of labor and other unfavorable conditions now affecting us, seriously threaten the South's greatest industry. I am not an alarmist, but if our scientists are correct and the Mexican cotton boll weevil is to continue his eastern march, it becomes not only the part of wisdom, but also the part of necessity to prepare to meet the destructive invasion of so serious an enemy. In looking over the situation it seems to me that the diversification of crops, where that is practicable, holds out more promise of relief than any other thing. In Louisiana we are peculiarly and fortunately blessed with a soil and climate so varied and congenial as to permit of the successful growing of many crops. We are not dependent upon cotton alone, though the abandonment of its culture would seriously disturb and upset our economic conditions and place hardships upon all our people. Experiments in Texas have proven conclusively that by intelligent practices, by adopting cultural methods, by planting early fruiting varieties and using a fertilizer that will force rapid growth and early maturity and then an early burning of cotton stalks, etc., cotton can still be raised at a profit. But boll weevil or no boll weevil, diversification of crops is still the system that ought to be practiced, because it is the rational system, the system now needed and demanded. Diversified farming means many crops, a succession of crops, a rotation of crops, and this in turn means an improvement of soils and an increase of crop production.

"In its final analysis, diversification means intensive farming, the application of scientific principles and methods and the intelligent use of fertilizers and modern farming implements, which in turn means maximum production at a minimum cost and on a smaller cultivated acreage. Diversification means even more than this; it means the production of live stock for home and for the market. For after all, 'stock raising is the strong right arm of agriculture.' The raising of more live stock and the proper handling and application of the manures to crops and land would improve the one and increase the other. This is a 'consummation devoutly to be wished for,' and in line with the best thought and practice of the day. It is expected, of course, and advised, that the best blood of the kinds preferred be used. None other is in demand. The day of the 'scrub' is gone, I trust never to return again. If the scrub, then we acknowledge ourselves 'scrub' farmers, and if that be true (I deny it), then it is right to have scrub animals throughout and continue to give scrub care and attention and receive scrub returns from all, except the manure. For that the scrub is as good as any.

"Hand in hand with stock raising, dairying could and ought to go, wherever there are market facilities to justify it. And from my observation and knowledge there are more home markets for dairy products than there are dairy products for them, and so long as we find dairy products from the North and West upon our own markets, let us not cry out, 'No market.' Let us rather turn our attention to these new matters and see after a fair, honest and intelligent trial if there isn't something in them. After the market, in dairying, comes good dairy cows, cheap, nutritious feed, pure water, intelligent care, attention and practice with modern dairy machinery. All these essentials we possess, or may acquire, with patience and effort. The essentials of cheap, nutritious feed, these we have convenient and in abundance in the by-products of our cotton oil mills, sugar houses and rice mills, and to spare, and do spare to the North and West for similar purposes. Dairymen and feeders there pay high prices and freight on our cotton seed meal and regard it as their best and cheapest source of protein, the milk and beef producing element of all commercial food stuffs. There is room and market about all our towns and cities for modern, up to date dairymen, and among our small farmers throughout the State farm dairying, *en famille,* where the work can be performed by members of the family, holds out a promising field for endeavor in that direction. With the by-products of the farm and dairy, hog and pork raising would receive a stimulus and impetus, and until all our smoke houses and corn cribs are removed from the West and North on to our own farms we should not be afraid of overdoing the business.

"But let us consider briefly some of the other crops we might grow profitably. Our soil and climate are so favorable for the production of a great variety and wide range of crops, that it would be difficult to enumerate what crops we might not grow profitably, and since this is a practical question, and theory not popular at this time, I shall refer only to those crops which are proven practical successes.

"Beginning here at Shreveport, in the Red River Valley, be it said to the credit of the planters there operating, and let it be proclaimed to the world that here in this far-famed valley the prince of hay crops, alfalfa, has achieved an extensive commercial success. The pioneers in its production, whom I know personally, have not only created a local market for alfalfa hay, but by organized, concerted effort they have raised the market price of alfalfa hay from almost nothing, first to about $8.00 per ton and now to $15.00 or $16.00 per ton, and that within the past few years. With the average year and conditions from three to five cuttings per year, or that many tons per acre, may be reasonably expected, or an annual gross crop of $45.00 to $75.00 per acre. With favorable conditions larger returns are sometimes secured and may be reasonably expected.

"As a supplemental crop, what better promise might one seek to meet the pending emergency. Hand in hand with stock and pork raising it will go, and indispensible it will be, wherever it is practicable to grow it, and its growth is practicable and so proven upon any well drained alluvial land of the State. We have something like 19,000 square miles of alluvial land, perhaps there are not more than 5,000 acres of it now in alfalfa, so that with good markets and a large area of land suitable for its culture, and yet importing it from the West, it seems there is something we can do in the direction of alfalfa hay raising. Many of our sister States, less fortunate in this respect, would be only too glad to have our opportunity to thus own so valuable a money crop as alfalfa, which does not exhaust land, but on the contrary improves and enriches it from year to year. Other hay and grazing crops like the cow pea, white and red clover, rape, sorghums, oats, barley, lespideza, Bermuda grass, etc., for grazing and soiling would prove valuable adjuncts to stock raising and can not be ignored in this emergency.

"Truck farming is and may be practiced extensively throughout the State. According to the last census report, Louisiana then produced truck to the value of $3,000,000, with net acreage value of about $42. I doubt if any other crop we cultivate can show as well as that. The sandy character of the soils of the Northwest Louisiana hill parishes, with their red clay subsoils, pre-eminently adapt them to truck growing. Throughout this section vegetables of all kinds, melons, berries and peaches of superior quality and sweetness grow luxuriantly. Commercial orchards and gardens ought to be and will be growing wherever the proper railroad facilities are available. With the proper effort and encouragement North Louisiana will rival Tangipahoa in the production of early vegetables for the Northern markets. At several points along the Vicksburg, Shreveport & Pacific Railroad, notably at Minden, Ruston and Calhoun, results of efforts in this direction the past year were encouraging and successful. From $45.00 to $85.00 per acre were realized and the business will continue and expand the coming year, with other communities joining the truck and fruit procession. It is no longer debatable or doubted that the Elberta and other varieties of peaches are here grown to perfection, or equal to those grown in the most favored sections of our country. Commercial peach orchards are being planted, interest is aroused, attention quickened and encouraging results will soon be apparent. Likewise can 'bright leaf' tobacco, equal to that of Virginia and the Carolinas, be grown upon these sandy lands.

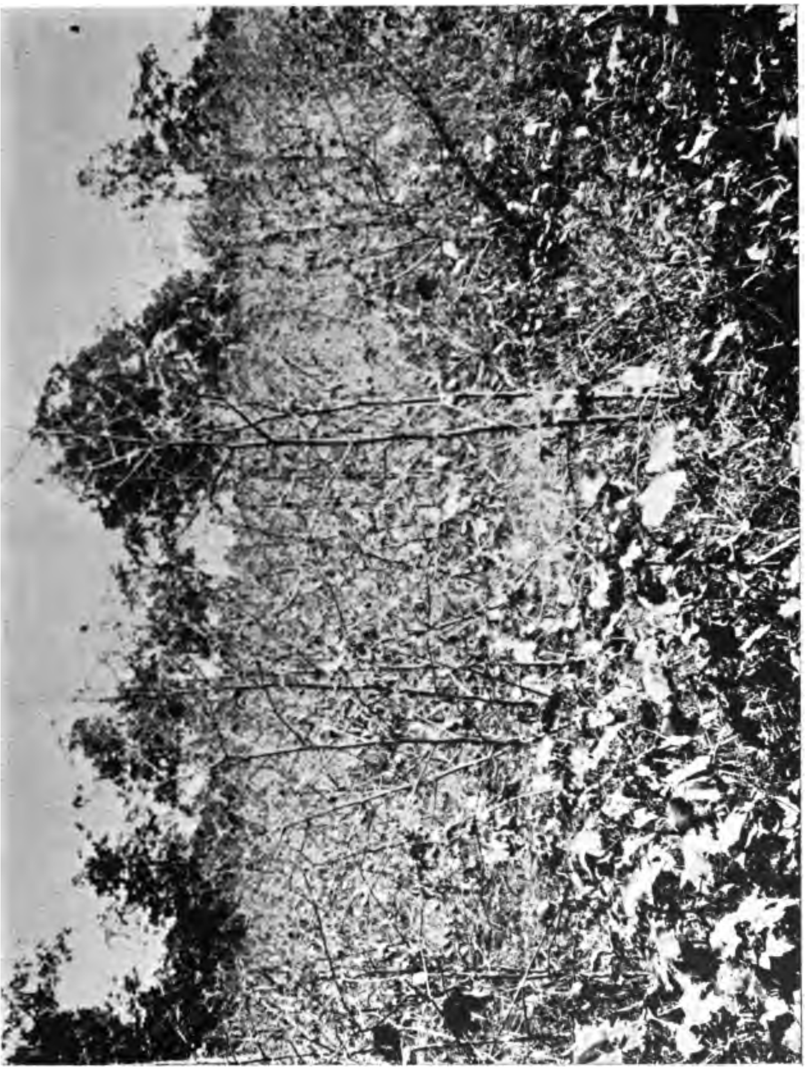
"Mr. Chairman, I might go on indefinitely, enumerating crops that might be successfully and profitably grown. After all it is a question for the individual to determine, according to his own taste, his environment and the exigencies of time and place. That the farmer and planters of Louisiana, with so much of advantage in soil, climate and resources, will be equal to the emergency I have not the slightest doubt. If one had then said the drouth of '96, here in North Louisiana, 'was a blessing in disguise,' it would have been past believing, yet in the light of time and experience we now know that it was, in that it taught economy, diversification, the production of food crops for home and farm; fertilization, rotation and more than all, less credit, fewer wants and fewer debts. Today our farmers are more prosperous than I have ever known them.

"Regarding Louisiana and her agriculture, I am not a pessimist. Through the dark cloud appearing on the horizon the sun will soon break. Perhaps before it does, we will suffer deprivation, but a brave people and rich land like ours will overcome all difficulties. The diversification of crops will solve the problem. Then capital and immigration are coming and will continue to come. Our 24,000,000 acres of now unoccupied lands will yet be cultivated. Our waste places will be built up and developed, and our fair State made 'to blossom like the rose.' 'Necessity ever was and ever will be the mother of invention.'"

At the close of Major Lee's paper, Prof. D. N. Barrow, of the experiment station at Calhoun, delivered an address on the same subject. He said:

"The discussions of this session have been devoted to the all-important question of how best to combat the boll weevil and make cotton in spite of him. There have been many valuable

Plate VII.



Field of Native Texas Cotton Planted Same Time as King Cotton (See Plate VIII) Only an Occasional Boll Open at Time King Was Ready For Second Picking.

points brought out and much progress along these lines has been shown. But in all these discussions there has been shown but one effective method of extermination of this pest, that of starving him out by ceasing to raise his food plant, which we are told is cotton, and cotton alone. Without presuming to doubt this statement, for it is made by the scientists, and you know scientists are honorable men, I might call attention to the fact that up to this year the scientists stated that Mr. Weevil would not fly any distance for food.

"Now, if it becomes desirable or necessary to cease planting cotton, what crops are we to substitute? As blessings frequently come in disguise, it may be that, in forcing us to turn our attention to other crops, the boll weevil may even prove such; for we are all too prone to stake our all upon the one crop. An investigation of the capabilities of our soils discloses one, to many of us, astonishing fact. It is easier to answer what crops can not, rather than what crops can be grown upon them. With so many to choose from we will waste no time in speculation, but presume it is a known fact that fruit and truck of all kinds can be grown. That the growing of these things can be made to pay will admit of no discussion when we witness what has been done in other sections with soil and climate similar to our own. In my remarks I will confine myself largely to a statement of what has been done already in the growing of fruit and vegetables in Louisiana. Referring those who wish to learn of the greater possibilities of this industry to Col. D. H. L. Bonner, of Omen, Texas, than whom Texas never had a better exponent.

"Being convinced of the adaptability of the hill sections of this State to the growing of fruit and vegetables for the market, the North Louisiana experiment station undertook to demonstrate this fact in a practical way the past season. We planted such areas as would warrant the shipment of the products and the actual testing of the value of the products upon the markets. The interest of a number of the best farmers was enlisted, and with their aid a truck and fruit association was formed. The main crops planted for shipment were tomatoes, potatoes and onions. Besides these three crops, quite a variety of others were planted in lesser areas. The writer was constituted shipping clerk and personally saw to the packing, shipping and selling of the produce. At the end of the shipping period the producers received such amounts as would constitute a gross profit on truck of over $85.00 per acre. That is, after all shipping expenses were paid, each producer had at the rate of $85.00 with which to pay his labor, land rent and fertilizer bills. The vegetable costing the most to raise and market in this list was the tomato. This, a careful record shows to be between $35.00 and $40.00 per acre. Thus we have a profit on one acre of tomatoes of over $50.00. Owing to unfavorable seasons, neither the yield of tomatoes nor of potatoes was up to the maximum possible. The greatest yield of tomatoes was 275 one-third bushel crates, while seventy-five bushels is about the best yield of potatoes. It is only fair to state that a yield of 400 crates of tomatoes and 150 to 200 bushels of potatoes is not an extra large yield. The experiment station has gathered over 300 bushels of potatoes per acre. We sold our potatoes on the track for 75 cents per bushel. The onion crop did better, one party reporting a yield of over 100 bushels, for which he received $1.00 a bushel, and netting him a handsome profit. Of the other crops we must not omit the cabbage. These were sold the latter part of June for $2.50 per crate, bringing over $200.00 an acre. Ordinary string beans sold readily for $1.25 to $1.35 per bushel and yielded over seventy-five bushels. Lima beans sold for $1.50 and English peas at $1.25 per bushel.

"We shipped, rather late in the season, Elberta peaches that sold in the markets of St. Louis and Cincinnati for 60 cents per one-third bushel crate. This fruit, owing to the limited quantity at our disposal, was shipped by express and arrived on the market in poor condition. The few crates that arrived in good condition were pronounced as fine as any on the market and should have sold for $1.00. But even at 60 cents we realized over $5.00 per tree. Figure this to the number of trees per acre and you have quite a nice margin for profit. The best sales of fruit, however, were made with the Japanese May plum. Five crates were shipped experimentally that sold for $2.00 a crate. This tree produced over fifteen crates. Even up to the time of our last shipments, the latter part of July, these plums sold readily for $1.00. We have heretofore made no attempt at shipping the strawberry, but experience in raising them tells us that nowhere does this plant thrive better than in these hill lands. The Lady Thompson has proven itself the best fitted for these soils and is an approved shipper. I know of but one attempt to raise the grape for the market. This is the very successful venture of Mr. A. B. Fisher, of Doyline. Mr. Fisher has succeeded so well in his venture with Nortons that he is rapidly increasing his acreage.

LESSONS LEARNED.

"The above is a brief resume of our experience in the fruit and truck business for one year. 'Are our people satisfied?' The fact that the acreage will be increased from barely fourteen this year to nearly 150 next, should answer this. This year's work was in the nature of an experiment, and for education I have given the results of the experiment, but we would be dullards indeed had we not learned many valuable lessons. The first important lesson learned is that there is a paying market for everything this country can produce in the shape of early vegetables and fruit. While the surplus of our gardens is going to waste, there are hungry thousands crying for it, if we only knew how to get it to them. The next lesson of importance is that only first-class stuff must be shipped, and these must not only be packed in the best possible shape, but must be so handled that they will reach the consumer in the very best condition. The transportation charges are the same for poor quality as for good, and the cost of the package and other charges are the same, irrespective of quality. It is, therefore, poor policy to ship a package that will not bring the top price in the market. In no industry than this is honesty a better policy. Never attempt to fool the buyer by putting the finest and best on top. He is sure to detect the fraud and the result can only be disappointment. If your goods are of different quality and you must ship seconds, then mark them as such and pack them separately. We learned that the best disposition to make of this inferior fruit and vegetables is to put them up in cans, thus saving them for

Winter use. With a little home canning outfit, costing not over $10.00, one man and two children can easily put up 300 cans a day, thus not only saving what would otherwise be lost, but at the same time providing themselves with a liberal supply of canned goods, far superior in quality and beyond the possibility of competition of the regular cannery. So superior is this freshly canned home product that it will readily sell at an advanced price over the product of the regular cannery when it is once known.

"Another lesson learned very emphatically is that in order to reap the greatest profit you must raise in sufficient quantity so as to be able to ship in car lots. Not only do express shipments cost four to five times as much in freight charges, but the condition of the goods upon arrival upon the market is much inferior to that shipped in car lots. Seeing, as I have, cases of peaches and other tender fruit tossed from one end of an express car and dropped upon a pile or upon the platform by the express messenger like he would drop a hot iron; the wonder is not that the goods did not top the market, but that they sold at all. It only emphasizes how hungry the fellow must be who bought our stuff.

"The necessity of car lot shipments points the fact that organization is an essential to success. Truck crops require relatively a large amount of labor, as they have to be handled rapidly. It is almost impossible, were it advisable, for any one farmer to plant and handle sufficient acreage to do this, and it is only by concert of action with his neighbors that car lot shipments are possible. But what is everybody's business is generally poorly done, and it is advisable to organize into a truck association. Elect a president, a secretary and a shipping clerk in whom you have every confidence. Adopt certain necessary rules, live up to these rules and let your officers transact the business. No man should go into such an organization unless he has confidence in the ability and integrity of its officers and is going to obey the rules. If you have a proverbial kicker in your organization, turn kicker yourself and kick him out. My word for it, he will prove more destructive to the accomplishment of the aims of the association than the proverbial bull in the china shop.

"Judging from what I have seen you can hardly make a nistake in the selection of crops to grow. But as we are probably nore familiar with them, I would suggest potatoes, cabbage, onions, beans (snap and Lima), tomatoes, peas and radishes. The Tennessee Triumph potato, the Early Brunswick and Flat Dutch cabbage, the Red Bermuda or the Creole onion, Early Mohawk and Bush Lima bean, Early turnip rooted or the French Breakfast radish, and Livingston's Beauty tomato are the va-ieties that have proven best with us. Remember that as it is he early bird that gets the worm, so it is the early vegetable hat gets the best price; therefore, use every means in your power o hasten the maturity of your crop.

"SOILS AND FERTILIZERS.

"Truck growing is emphatically intensive farming, and one f the main benefits to be derived from its adoption is the lesson t teaches in soil improvement. It is absolutely necessary that he soil on which vegetables are successfully grown should contain n abundance of moisture and at the same time should be well drained. Our sandy soils are generally well drained, but are too ften lacking in the requisite moisture. This defect can largely e corrected by incorporating into it vegetable matter, and there s nothing better for this purpose than the turning under of a ood cover of pea vines. There is no fertilizer for truck crops omparable with stable manure and compost, but with certain rops like potatoes this must not be used in the fresh state. The reen manuring and stable manure form the foundation of truck-ng, but it is to commercial fertilizers that we must look for urrying our crop to maturity. The rapidity with which certain lasses of these substances give up their plant food make them eculiarly fitted for this use, and the intelligent truck grower ses thousands of pounds where the ordinary farmer uses undreds per acre. The correct composition varies with different egetables, but as a general rule a mixture of five parts of cotton ed meal with three parts of acid phosphate and two parts of kainit, will prove satisfactory. This mixture can well be supplemented with fifty pounds of nitrate of soda to start the crop off. As a general rule larger quantities of nitrogen should be used where leaf or stalk is the crop than where the fruit is desired. Again, it should be remembered that plants of the pea or bean class can gather a large share of their nitrogen from the atmosphere. Where the plant itself is consumed, rapid growth is conducive to tenderness, a condition fostered by heavy fertilizing. Eight hundred to a thousand pounds can profitably be used on potatoes, while the cabbage and lettuce will easily use twice this quantity. The very mention of these large quantities of fertilizer should teach the importance of thorough and deep preparation of the soil, not only that the plant roots may have free access to the food in the soil, but also that the soil may hold sufficient moisture to dissolve and render that food available to the plant.

"The ideal truck soil is a light, sandy loam. This class of soil is proverbially poor, but the mechanical condition is of such paramount importance that we can better correct its poverty than attempt to remedy the former.

"Now, what varieties of fruit can we recommend? Here, as elsewhere, the Elberta is Queen of the Orchard. The excellence of all other varieties is entirely measured by its approach to Elebrta. After a series of years' tests in a variety orchard, the peaches making the best showing are Greensboro, Sneed, Mamie Ross, Elebrta and Crawford's Late. The value of the first three lies in the fact that they ripen before the Elberta. But when Queen Elberta makes her debut upon the market, all others take second place.

"In locating an orchard, select, if possible, a sandy loam, underlain with clay (red) or coarse gravel. Remember that it is the iron in the soil that, under the influence of the sun, paints the color upon your peach, and color goes a long way towards selling them. Still bearing this in mind, give your trees good distance that the sun may have free access. Twenty-five by thirty feet apart is none too much distance. Buy nothing but first-class June buds and, if possible, set them in the early

Winter. There is no better preparer of orchard soils than pea vines. Before setting break the soil good and deep. It is not desirable to push young trees to a too rapid growth, so the first year they need hardly be fertilized. Until the trees come into bearing the intervening space can well and profitably be used in the growing of vegetables. Whether these are grown or not, by all means cultivate the orchard during the growing season, being careful, however, that this culture is shallow, so as not to injure roots. When the trees begin to bear it is not best to grow any crop among them. At this time they require all of the plant food and moisture the soil is capable of supplying for the perfection of their fruit. At this time a dressing of five or six hundred pounds of bone meal, together with a few hundred pounds of some potash salt will be found beneficial. Then, in the Fall, a cover of red or crimson clover may be provided; this to be chopped in the next Spring with a disc harrow.

"I have thus briefly given a few lessons from experience and outlined a few points upon which the would-be trucker or fruit grower should be informed. I do not care to be understood as urging this industry as replacing cotton. I, for one, have an abiding confidence in the ingenuity and the ability of the American mind to overcome and conquer obstacles, and believe we will continue to raise cotton in spite of the weevil. Nor will the growing of truck necessarily reduce the crop of cotton. Smith County, Texas, one of the largest shippers of truck, is today producing more cotton than she ever did. I would urge your attention to this industry rather along the lines of diversification. The truck industry posesses a great advantage over most all other field crops in that it brings quick returns and large returns from small areas. Your money is in your pocket by the end of June or middle of July, and there is not an agriculturalist here who can not appreciate the feeling of money in his pocket at that time of year. Trucking also furnishes light and profitable employment to the women and children. It is pleasant work and hence is removed from drudgery. Last, but not least, besides giving a diversification of crops, it teaches the farmer, as nothing else will, the value of high fertilization and good culture, and you have yet to see a successful truck grower who does not make better corn and better cotton than his all-cotton neighbor.

"Gentlemen, we of Louisiana have the finest soil on God's earth; we are the favored children of the King of Day, for on none does he shine with greater benignity; on no people do the showers of Heaven descend with greater favor; we have as much brawn and muscle as other people, and stored in our heads is as much gray matter as is found elsewhere. With these advantages it is only necessary for success that you determine to take hold of a thing. You can raise truck, and it will pay you. Will you do it?"

The convention adjourned at 12:30 until 1:30 for lunch.

AFTERNOON SESSION.

The afternoon session was called to order by President Schuler, who introduced Prof. J. H. Connell, editor of *Farm and Ranch,* of Dallas, Texas. Professor Connell was on the program to deliver an address on the subject of "Effects on the Boll Weevil upon Operations in Texas," but announced to the convention that he would choose for his text, "Set your house in order, Louisiana." *

Mr. N. T. Blackwell, President and General Manager of the *Cotton and Cotton Oil News,* of Dallas and Memphis, said:

"From what I have heard here today, and from the attention you have given the speakers, I believe that you, as well as I, have been greatly benefited by these proceedings. I want to ask your co-opration with your local papers. If any man, in the cultivation of his crop, finds an idea worth giving his neighbors, give it to your paper. If you have anything, write it out and send to your paper and help promote your neighbors by dividing your idea.

"I will appreciate anything you will send the *Cotton Oil News* at Dallas. We are interested in the general welfare of the country and want to help the people and they help us in return."

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* The copy of Professor Connell's paper was received too late for publication in this book.

Mr. Stanley Watson, of the Houston Central, with headquarters at Houston, spoke on the "Railroad's Interest in the Boll Weevil." Mr. Watson said:

"The railroads take a great interest in the boll weevil, because their investments are large; therefore they have to figure everything to the minutest detail. Even under the most favorable conditions, the profits of the railroads are small. We are greatly interested in anything that concerns cotton, because every time cotton moves there is a rake-off for the railroads.

"The object of the railroad companies is not to develop ways or means of the farmer, but it is their object to see that success is told to the people along the line. We are not farming, we are railroading, but we want to see the farmer succeed: we want to see them make big crops, for, as I said, the railroad gets a little rake-off on the stuff they haul.

"We took up the question of the boll weevil in Texas. There is no official connected with the Southern Pacific Railway Company who has not spent hours and hours of his time thinking on this problem, for it concerns each and every one connected with the company. There is nothing that has weight with the man who signs our check but absolute return. When year after year passes and fail to show increased revenues, some of those checks will fail to be signed. For that reason the railroads are studying the question for themselves.

"We judged by the evidence before us. There were some farmers in the boll weevil district who were making cotton, why could not they all make cotton? So we went to those people who were successful and asked how they did it. We read the bulletins published by the Agricultural Department of the United States. We talked to those people and we talked to the farmers and told them to consider this question in a dispassionate way—there is no sentiment in it, it is simply a question of dollars and cents. We decided from the evidence before us that the question before the Texas farmers was one of education. We believed that if the farmers were told how others farmers made their success, they could do likewise. This we made an effort to do. The farmers' institute was the most valuable means. We had representatives of the Texas Agricultural and Mechanical College, practical farmers of special crops, etc., to deliver addresses at these institutes. We held meetings in fifty-two towns on our lines. We would send a man in advance of our institute meetings. We would issue circulars like a circus announcing the meetings, and they were sent ahead that the people might know we were coming. We had advance agents everywhere. In many instances the company furnished a private car for the speakers of these institutes. They told the farmers of the habits of the boll weevil. They urged diversity of crops. They organized farmers' institutes and fruit growers' associations, etc. We impressed the people that they were looking at the question from the same standpoint that we were—it is a question of dollars and cents.

"In our recommendations we urged the farmers to try to make early cotton. We urged that they plant early varieties of cotton. We urged that they prepare their land better than they had ever prepared it before that their cotton might grow rapidly. We urged that the cotton be planted wide apart, so that the sunshine could get in between the rows and thus destroy the weevils that fell between the plants. We urged that they continue cultivating. And as a result of these efforts we had an increase on the Houston & Texas Central Railroad of 525 cars of fruits and vegetables. The cotton increase was gratifying. (He read statistics, which he said were not for publication, showing a vast increase). We have 500 farmers following the instructions of the United States Government's Department of Agriculture. Our institutes all combined to make this result.

"From those figures we are decided to make the same recommendations to our people next year as we made this. We are going to try to build up in the same manner all the towns along our road. We have sown and profited, and believe we will sow and profit each year.

"There is a point I wish to call your particular attention to. On the subject of diversification, when a man goes to studying some other crop, it brings about improvement in growing all crops. I do not believe there is a farmer anywhere but what will be benefited by a little studying and by so doing improve his method. I recommend to the farmers of Louisiana that you organize farmers' institutes. The boll weevil is probably coming to you, and you will doubtless have hard times, but my advice is to take hold of the subject and study it."

Major Lee asks:

"Will you offer the same co-operation in this State as in Texas? One of the hardest problems with which we have to contend has been the lack of funds and co-operation from the railroads."

Mr. Watson replies:

"The Southern Pacific runs from New Orleans to San Francisco and we will render co-operation all along the line to help the good work in Louisiana as in Texas."

Professor Connell said:

"The railroads can not afford to do less for your farmers than they have done for ours. They have torn the bars down and stand at your service for agricultural interest."

Col. F. L. Maxwell said:

"Having had some experience some few years ago in the sandy land on the Mississippi River, I will give it to you: Labor was plentiful and I made a suitable arrangement with the railroad whereby I was enabled to raise potatoes quite extensively. One year the crop was good, labor was plentiful, and when I wound up my crop, about May 20th, after paying all expenses, I had $10,000 to my credit. I shipped 10,000 barrels of potatoes. But I had to abandon this because labor got scarce and transportation increased on me. Since the boll weevil has come, if the people can get a good rate, they can go to raising Irish potatoes again."

Mr. Glassell called a meeting of the Committee on Organization.

Dr. S. A. Knapp, of Houston, spoke on "The Cotton Co-operative Experiment." He said:

"Mr. Chairman and Gentlemen:

"The boll weevil has been discussed from the North Pole to the South Pole, and nearly all the points have been covered, and I will confine my remarks to only a few points.

"It has been proposed here today as a remedy, in part, at least, that we diversify our agriculture. While I am a friend to diversification and have instructed all agents, as far as possible and practicable, to practice it, at the same time I wish to say to you that it is not a remedy. It can be used and be helpful, but it is not a remedy—at least that form of diversifying to which illusion has been made. Take truck gardening, how can a man residing ten miles from market get his truck there. The farmer may make this a success who lives two or three miles from the shipping point.

"In the next place, your lands are not adapted to it, except such items, perhaps, as Irish potatoes, which belong to the farm garden rather than to general trucking. The land must be improved. It should be cultivated to a great depth. It should be filled with humus. You must cultivate your soil a foot in depth. You are not prepared to go into trucking, and supposing you were—suppose the great State of Texas and the State of Louisiana should go into truck gardening exclusively, why they would supply the markets of the world, to say nothing of the United States. I remember when the truck gardens along the banks of the Hudson supplied the City of New York. Now, with a Republican President, a great deal of trucking can be done in the West Indies.

"One important point we enjoy is that we occupy the extreme limit of the South, and the products of the Gulf Coast has controlled the market of the United States for thirty years. Take the onion we raise. It is better; more sizeable; more even; better flavored, etc. Therefor, to a crtain extent and to a certain limit, we enjoy particular advantages that will never be taken from us. Yet under the present circumstances, it is the wise man who rises up and looking at the problem that confronts us, asks 'What can I do?'

"Every farmer can commence to diversify a little, and every one should rotate to some extent. The continuity of crop on the same land means poverty and disaster, deep and wide. No single crop farmer that continues to crop on the same land but has led to poverty or total ruin in this country or others. Therefore, we must, to some extent, diversify our crop, and we must have rotation of ground in order to preserve fertility of soil.

"But this diversity—what can it do? We can produce the things we consume on the farm. We have been buying our meat from the Northwest, when $75,000,000 hog products was sold in Texas. That amount of pork and beef could be raised in Texas without reducing cotton one pound. It is, therefore, a waste and an extravagance, and one of the first things for the farmer to do is to return to the old-time farm life of living at home. Produce and keep an independent farm.

"He should also have a small cash crop so he can pay his current expenses and the cotton is a clear gain to the farm, and the money he received from it can be placed in the bank. So much for diversity and truck farming. Where the man is so situated he can get large returns, but it is of general farming that we wish to speak.

"I do not believe the remedy for the boll weevil is to quit raising cotton. That theory is impracticable. The economic civilization of the South is built on cotton. Of all the cash crops in the world, there is nothing like cotton. Your vegetable crop has a limited market, while cotton goes not only all over the United States, but goes all over the entire world. The demand for cotton is increasing more rapidly than the production. Other countries have raised considerable cotton—India and Egypt, and Russia is almost self-sustaining, but the demand is for American cotton, as it is far superior to any other. In the East they plant too close together, the bolls are small and the lint is short. Only inferior grades can be raised in India and only inferior grade of cloth can be made from it. It requires a high intelligence to produce a superior quality of any fruiting plant. Therefore, the people of the United States, with their superior knowledge, can produce, and do produce, a staple which commands the markets of the world. We have learned how to handle cotton. Nearly all the fabrics suitable for clothing are of cotton; it has almost driven out linen. It is the leading material with people all over the world. Shall we abandon it because a little insect has invaded our territory? Not at all. The American people are making cotton today, and they are going to make it tomorrow, and next year, and no man need look forward to the time when cotton will be abandoned. It is the greatest crop of the South and always will be. We are determined that there shall become more and more cotton producing people in the future than there has been in the past.

"When the boll weevil made its appearance the whole life fabric of the agricultural interests of the world was shaken. In Texas it undermined whole communities and they went to the wall. When they failed to raise a cotton crop for three or four years, failures were everywhere. The laborers became disheartened and discouraged, and unable to meet failure, left in the night, seeking other places where the boll weevil had not ravaged, or places where they could live without cotton. Where they could make a living on potatoes, corn, wheat, etc. Large sections there, covering entire counties, were unable to make bread and butter. The situation became serious. Bills were passed in Congress making appropriations to aid in fighting the march of the insect. The various Representatives from the South met in conference to consider how best to meet the ravages that then threatened the destruction of the 'Southern King.' The President was appealed to and the Secretary of Agriculture was called on to lend assistance in the fight against the pest. He asked me what I recommended. I replied, 'Mr. Secretary, it seems to me that this is an emergency that can be overcome, and by proper effort we can make a cotton crop.' He said, 'What can we do?' I said to him, 'We are told by the entomologist farmers of Texas that a crop can be made. In my observation in the State, a crop can be made.' He then asked why they did not make crops. I replied, 'They either do not know how, or they have lost courage, or are unable to make financial arrangements. I am opposed to giving these people anything, except in extreme cases. I am in favor of every man earning his own money. Any wholesale contribution to the people is a mistake. I speak for the best interest of the people that I represent. We must organize and get these people to help themselves.'

"I understand it was remarked here last night that what

I was after was a job. I merely wish to state that I had a position that I much preferred to this. But it was finally decided that I should go, because I was acquainted with the people of Texas and Louisiana, and we needed all the force we could get.

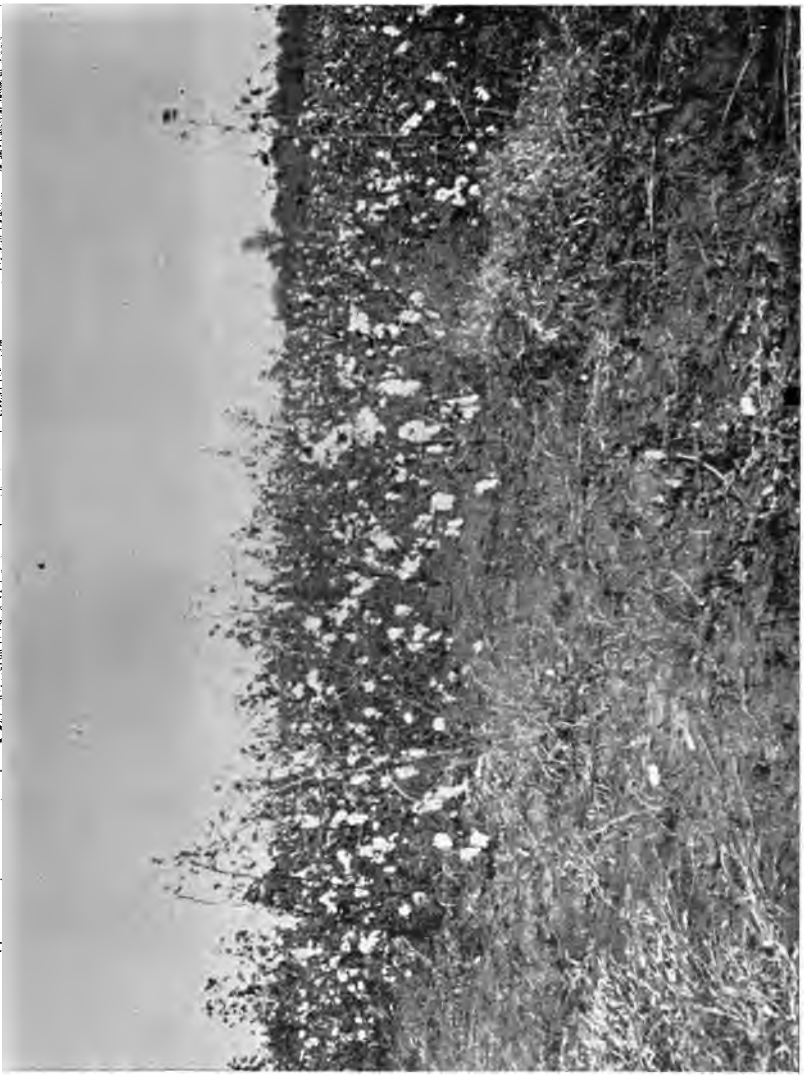
"We opened our campaign about the 1st of February. We put ourselves in line with the railroads. We had conferences with the railroad agents and discussed the proposition with them. We explained to them the best plan was to go into the different counties and organize and get the people to make cotton on a plan which would succeed, which plan was to bring to bear all the improved methods of agriculture; to plant early and hasten the crop, for it is a fact known by the entomologists that there is not so much danger until July or August. Therefore, if they would plant early and study the use of fertilizers, they could get a crop before it was injured.

"An influence that did much good was the farmers' institutes under the control of the Agricultural and Mechanical College of Texas. They came to our support, and then we called in the prominent business men, and to them I owe my highest gratitude. These were our forces. Our men were sent out to call meetings of the business men—the merchants, bankers, etc. We told them of our method of agriculture, and assured them that crops could be made if this plan was followed. We told them that if the farmers followed these lines you need have no fear in advancing them. In ninety-five cases out of a hundred this was a success, for they would turn to their citizens and tell them to take this plan and carry it out. Seven thousand farmers agreed to co-operate and report the success they had, but there were between 40,000 and 50,000 who did not agree to report.

"By means of institutes, as explained by Mr. Watson, discussions were held everywhere, in which all the intelligent men of the State co-operated, and we were thus enabled to bring it to the attention of the people. Where these meetings were held much good resulted. But we did not begin until in February, and that was too late to do good work in the Southern part of the State. We should have been there in the Fall. That is where the weevil first made its appearance in the State. The farmers there have a lazy way of raising cotton, and also a lazy way of raising boll weevils. They raise stubble cotton, instead of having a Fall clearing, as they should, so that when the cotton comes there are a million weevils looking at it, and it's a fight between the weevil and cotton as to which gets the best of it. Last Winter was mild and dry and there were millions of weevils on the cotton —the weevils were on top and the cotton under. The thing to do is to clear and clean the ground in the Fall—burn the stalks. If these people had done this, they would have made successful crops. But they want an easy way of making cotton, but it was a failure in that section. But those sections which did not Winter their stubble cotton—the Brazos section—was also ruined. In one section 600 farmers had gotten so low that it was necessary to raise funds to furnish them melons and potatoes, etc., in order that they could make a living. I sent a man to stay with them and instruct them how to plant and how to make crops. The result was they raised five times more cotton this year than last. They raised 70,000 bales more this year than they raised last year. In fact, at your meeting in Houston week before last I found it necessary to suppress some of the facts, as it looked as if we were holding a mutual congratulatory meeting.

"In one of the worst sections of the boll weevil district there was one of our co-operators wrote me he raised more cotton than he had ever done in his life. He followed our instructions. He planted wide rows so the sun could get in and it killed nearly all the larvæ in the squares. He made eighty bales, more than he had ever made in one year before. The methods we are pursuing are as good for cotton that had no weevil as for those that have, because it leads to thorough cultivation and larger production of cotton. I can name one farmer in Texas who has followed our instructions, and he has made $20,000.00 more this year than he ever did before on cotton. He stated to me that he had a farm of 205 acres, about a mile and a quarter from the city. He planted a hundred acres of this in cotton on the shares with a negro tenant. The land was prepared and cultivated according to our directions, and produced five times more cotton last year than it had produced in the last ten years. Last

Plate VIII.



Field of King Cotton Ready For Second Picking Planted Same Time as Field in Native Cotton (See Plate VII) Shows Early Maturity.

year he made a bale to the acre—prior to that time it had produced a fifth of a bale to the acre. Of course he was satisfied.

"A prominent gentleman of Greenville organized sixty farmers. They sent for me and I spent a day with them discussing agricultural questions. We commenced by asking questions, and they asked questions until 5 o'clock, when I had to leave to make another visit.

"We have no fear but that the movement will go forward. There is nothing new about the plan. I decline any honor of our having originated anything. We have simply taken from the best farmers of the country, the best papers, from the Departments of Entomology and Agriculture, suggestions which have done such great work—they ought to have the credit far beyond what they have received, and I believe such faithful work as they are giving the people can not but be rewarded. All we claim to do is to go out and organize the people and get them to make the crop.

"You have to go out with them and stay to see that they practice and follow these instructions, in some instances. They get a paper, they read about the plans and say, "That is good; I'll try that," and that is the end of it. There was a Chinaman came to the United States and went to Yale. He was educated until he talked like an American; he dressed like the Americans. There seemed a great future before him. But he went back to China and married a Chinese girl, and remained in China. I saw him a few years ago and could not tell that he had ever been to America.

"And so with the farmer; he reverts; he goes back to his old-time way of plowing and hoeing; he goes back to his original environment. He needs something to get him out of the rut—and to keep him out. He needs a jack-screw to boost him up. We just 'jack' them up, and it works. It is simply a business principle. It is just the way the merchants do. Get hold of the strings of commerce and apply business principles, and it will work.

"Now, in these sandy farms, the weevil is a little worse than in the black soil. But in some respects, the sandy soil does better. It is better drained and you can get to work on it earlier, and this is a great feature for the sandy soil. You can produce good crops on it—you can produce anything you want to—you can make a crop that will match the bottom land farmer, and with a great deal less work.

"A few years ago, I went to Calhoun Station—a couple of years ago, it was. The farmers around there had an idea of selling out at $5.00 and $7.00 per acre. I made a plea for them to hold on to their farms, that the time would come when lands in North Louisiana would be valuable, and that if they sold now they sold for a morsel of bread and meat. I told them that notwithstanding the boll weevil has come, you can master him. The worst thing is a stampede, and the farmers should be taught to face the boll weevil—not to run from it. Colonel Weemper came over here and he was astonished. He said he never saw such enormous melons—I think it was the melons that caught the Colonel; he said they could not make those kind at home; they had cotton crops and money in the bank and were discounting notes for cash.

"When a farmer raises too much cotton he gets too much money. In many sections of the country, farms have increased $5.00 per acre.

"I am glad to tell you about the co-operation we have had. I am glad that those 7,000 farmers reported their success. That is part of our system, to tell of the success and thereby encourage others to succeed. Everywhere a meeting was held in Texas large numbers turned out, just as you have come out here today. They were interested and wanted to know how to make a crop. They quit talking politics and went to farming. The politicians compained that they could not get the farmers to talk politics, because they talked cotton all the time. The goods boxes were empty and vacant—the farmers were making cotton. The merchants complained because the farmers would not come to town—they were busy making cotton. I told them they needn't worry, that when they made their cotton they would come to town and spend their money, so the merchants would get it after all. Co-operation is what is needed in this fight. Organize in the communities and carry on the fight. There is no use going on in the old way. People will break away and change, particularly when the boll weevil gets after them."

The convention took a recess at 4 o'clock until 7:30 p. m.

NIGHT SESSION.

The night session was opened at 8 o'clock by Professor McCann's Orchestra playing a recent composition, entitled, "The Boll Weevil Retreat."

President Schuler addressed the convention on the subject of "The Value of Improved Implements in the Culture of Cotton." He said:

"To my mind the use of improved implements in the cultivation of cotton is as important a subject as has been discussed at this memorable and important meeting. When we take up the special discussions by the different papers, you will notice readily that fertilization as a foundation with rapid cultivation is a necessity in order to make a crop with the boll weevil in your fields.

"Conditions differ considerably on the farms throughout this section of the country. Methods that can be adopted in the hills will be more difficult to adopt on the larger plantations in the valley. One of the most important questions that has been touched upon in the discussions that we have had during the past two days has been the matter of educating the labor on our plantations to conditions that might be and will be in the near future. Rapid cultivation with old implements and old methods is hardly possible. Rapid cultivation, small acreage and increased yield per acre will be the battle cry for the farmer.

"Let us begin with fertilization. Gentlemen today have alluded to the fact that the foundation of truck growing, and in fact of agriculture of any kind, so far as fertilizers are concerned, is barnyard manure. You planters on the river may think that fertilizing with barnyard manure is not necessary. You try it. Have you tested the problem? Possibly the methods you have been trying were laborious in spreading the manure. Suppose you get a machine. Get a manure spreader and you will find the labor problem solved, as far as the application of the manure is concerned. Fertilization is as necessary to the river farms as to the hills. In passing through the fields from this city to Benton I have seen acres and acres that, in my opinion, a gentle shower of barnyard manure would have been beneficial. While speaking of the machine with which to distribute it, I wish to make a statement that some of you may think extraordinary, and that is that many farmers throughout the country really do not know that the fertilizer has to be pulverized with the soil in order to reach the roots of the plant. Frequently you see the farmers applying the fertilizer in the furrow without mixing it with the soil. This is a mistaken idea. First you have to take the fertilizer (I allude to the commercial fertilizer), small as the grains of it are, and thoroughly mix it with the soil in order that the roots may get the advantage. Dr. Hunter has alluded to the burning of the stalk, and a good deal of discussion has been had as to destroying the Fall growth, or top crop of cotton, that was simply breeding weevils for the next Spring. What implement is better than a stalk cutter? It is true that in an infested district where it is necessary to burn the stalks, the stalk cutter may not meet the requirements, but at the present time what implement could be more useful than the stalk cutter?

"In my travels I notice now and then the method of planting cotton by hand. Of course, you river planters have long since abandoned the idea of using four hands to do the work of one. You will find, however, numbers and numbers who plant that way.

"Now I come to the implement most necessary in the cultivation of cotton under present conditions—the cultivator. The time has come when rapid cultivation has become a necessity. Several years ago, while I was in Coushatta, I advocated the use of the cultivator in the Red River Valley, that it would take the place of labor becoming scarce. I have used the cultivator, because in my judgment rapid cultivation of cotton is necessary, boll weevil or no boll weevil. Shallow cultivation of cotton after the ground has been thoroughly broken prior to that time is practical. No intelligent cotton grower who has made investigation will admit that root pruning of cotton is injurious to the fruiting. That being the case, cultivation makes root pruning unnecessary.

"One of the speakers alluded to the fact that the sun dried up a great many squares and in that way hindered the propogation of the boll weevil. Do you know the cultivator as it goes through the row of cotton disturbs nearly every limb on the stalk. If there are any defective squares they fall to the ground at once. Then with wide rows, letting the sun have access, you can readily see the importance of having that kind of tool. In my opinion, and I have been cultivating cotton for a number of years, in my opinion no week should pass in a cotton field without the surface of the soil being disturbed. Ask the average farmer why he plows, and he will tell you, 'I break up my land because I want to plant it.' He does not know. If you will send to Baton Rouge and get the bulletin on the subject 'Why I Plow,' you will find the importance of frequently cultivating your cotton. I am not a scientist and do not propose to go into detail and occupy your time, when the bulletin is on hand at Baton Rouge, and a postal card will secure it for you. Find out why you plow. Therefore, in order to cultivate cotton, improved implements are a necessity.

"Let us for a moment map out a plan taught us here in these two days by the papers and addresses of the gentlemen here present. Every one will agree that profitable growing of cotton by the present methods will no longer be possible in the near future. Fertilization has become a necessity; varieties of cotton is likewise a necessity and the use of Paris Green while in the young stage no doubt is beneficial. Rapid cultivation; cultural methods forcing the plant to mature early. In other words July should become the cotton month instead of August. The sooner we take to these methods, the better prepared we will be for the coming evil.

"I am in hopes that in the near future the cotton picker, which they are already working in the Red River Valley, will become a success, as well as the other implements I have alluded to. Alfalfa has been spoken of here today. What would you think of a man who would take a grass blade and attempt to mow his crop of alfalfa with it? You would think him ridiculous, and so he would be. So is the man who attempts to grow cotton with the old time tools that are used by several in this country.

"Professor Connell has told us what Texas has done—these gentlemen have come from Texas to tell us what Texas has done. I imagine that if a man went to the Texas black lands with a Georgia stalk he would draw a bigger crowd than the circus did in Shreveport. Yet here we are close neighbors to Texas and are asking these gentlemen from Texas questions on how to combat the boll weevil, and yet we propose to retain the old implements for cultivation.

"Gentlemen, I thank you for your attention."

Professor Morgan read a report of the committee appointed to devise a feasible plan for calling together the planters of the cotton growing States. The report was as follows:

"WHEREAS, The production of cotton in the United States is endangered by the Mexican cotton boll weevil, declared by the authorities the most formidable enemy to agriculture ever known, and

"WHEREAS, The industries created by and depending upon the existence of cotton in the United States are world wide and a vital part of every civilized nation, and as cotton is now the principal fiber used in the manufacture of cloth, the demand for which is constantly increasing, and no other fibre plant is now known, or is likely to be discovered or produced that could take the place of cotton, and

"WHEREAS, No reliable and effective remedy for the eradication of the boll weevil has been discovered, nor is promised by the trained experts laboring to combat this evil, and as it now seems certain that in the short period of fifteen years the cotton producing area of the United States will be invaded by the weevil, and

"WHEREAS, The State of Texas has lost many millions of dollars before a method of producing cotton with the weevil present could be demonstrated, and as the cultural plan involves some readjustment of our agricultural methods, which should be fully under way before the weevil reaches new territory, and

"WHEREAS, It is absolutely necessary for farmers and business interests concerned in cotton to inform themselves fully as to the difficulties which the weevil presents in order that the disastrous experiences of many parts of Texas may be avoided, and

"WHEREAS, The seriousness of the boll weevil situation is not sufficiently understood, and procrastination, in the instance of this particular enemy, inevitably leads to disaster,

"*Therefore,* Your Committee of Fifteen strongly recommends the calling of a National Cotton Convention, to be held in the City of Shreveport, La., on the 12th, 13th, 14th and 15th of December, 1904, and that the Governors of the various cotton growing States be requested to appoint 100 delegates, who shall represent the cotton interests of each State, to the end that some means be provided for the control of the pest, and for the consideration of such means as may prevent its spread into the other cotton growing States."

Judge Pugh moves the adoption of the report and resolution, adding:

"There has been a great deal of discussion here on the different theories as to how to deal with the boll weevil. I believe that the planters should act conservatively in this matter. I believe that all the gentlemen who have talked here are sincere in their method.

"In order that the people of the South might understand the question that now confronts them, this convention ought to be held in this city, for I believe we are in the center of the cotton growing section of the world. It is a latitudinal plant and no section can compete with us in the production of cotton, even though a one crop.

"Prior to the Civil War the South was the richest spot on the earth. For four years the South was swept of its farms and homes, and then we underwent the period of reconstruction for fifteen years, during which time nothing was produced. Now, in a few years the South has again rebuilt, and in the face of its past, stands today with the richest countries of the world.

"I believe that if this convention that is to be held is to be a success, that the success of the convention will not only depend on the active and unanimous efforts of this community, but it will require the co-operation of the cotton planters of Louisiana.

"We, therefore, invoke in behalf of the cotton crop of the South, in behalf of this section of the State of Louisiana, the active co-operation of not only the people of this vicinity, but of every man who has the welfare of this country at heart. I believe these people are capable of solving this question, and they will arrive at some conclusion and some plan by which this evil will be eradicated from this country."

The report and resolutions were unanimously adopted.

Mr. H. C. Stringfellow moves that a copy of the resolutions be sent to the Associated Press, which motion was adopted.

Mr. John A. Skannal, of Shreveport, read a paper entitled, "The Oil Mill's Interest in the Boll Weevil." Mr. Skannal said:

"The unsolicited call made upon me by the organizers of this convention I wish had fallen to more competent hands, but, feeling as I do that each citizen should contribute to the success of this gigantic undertaking by every means possible, I shall not be found wanting in contributing my share to this crusade against the boll weevil pest, or in adjusting as far as possible the strained relations now existing in the minds of some people between the oil mills and planters of this section of our country. It could not be expected of me to even suggest or devise any new plan for combating this pest. The magnificent fortune offered by the State of Texas alone has directed the attention of the ablest minds throughout this broad land to this subject, and I am filled with hope and the promise of ultimate success. In Professor Morgan we have an entomologist specially fitted for these duties. alive to every phase of the subject, with a courage and detemination to meet all issues as they arise for the good of all. I am prepared, also, to state, and time will prove it, that in Mr. Frierson we have a scientist scarcely second to any, whose inate love of science has given him peculiar pleasures of investigation, together with his excellent business qualifications, fits him for his position on this Commission; and then Capt. B. W. Marston, the practical wheelhorse of the Commission, who has ideas, and lives up to them in word and deed, and to whom the whole South is indebted for the best and most economical way of destroying the caterpillars; and Col. Charles Schuler, the leader in everything that pertains to the advancement and good of the farmer. These are the heroes of this occasion, and in the name of the oil mills of Louisiana, I desire to thank them and to guarantee our heartiest and continued support, because if the farmers fail the oil mills fail. The merchant, the banker, the doctor, the lawyer, all go down together, so when calamity threatens every enterprise whose roots reach out to every hamlet and feed on the industry of the weak should now come to the front and give back freely of that fruit that the years have accumulated, that the tree may not die but continue to bear fruit.

"I have spent most of my life in the country. I know the privations and inconveniences of country life and look upon a pair of jeans pants with unbounded respect. At the same time I know the shortcomings of these people, the improvement of which I propose to call attention to outside of the boll weevil proposition and to answer to the farmer as best I can for this spirit of discontent and this unreasonable howl now going the rounds of the press about the oil mills combining to fleece the farmer. The papers are responsible for much of it. Read one newspaper, you have read them all. Parrot like they take up the cue and these papers, going as they do to every fireside, are read by people who can not see the other side; they accept all printed matter as true. I remember a few years ago when Grover Cleveland first made use of that celebrated saying of 'innocuous desuetude'—all the knights of the quill took it up. They wrang it in on any and all occasions in politics, in religion, in factories, in shops, in town, in the country, and love itself in every squib lapsed into innocuous desuetude, and so it goes with the press. These newspaper men, when they think they smell something and can't locate it, like a good dog they sit and bay the moon, and when off at a distance it comes to us like the deep-mouthed welcome of old dog Tray, who had really treed a coon.

"But there is another side to this question, and I must now enter my protest against this indiscriminate howl that the oil mills are swindling the farmer. I have no doubt but that you will find unscrupulous oil mill men as well as unscrupulous farmers, merchants or bankers, at the same time they are equal in integrity to any other class of business men. It has possibly never occurred to many of you that in the sale of millions of tons of manufactured products, some rules are necessary in settlement of differences. That bad seed make bad oil and meal, as numerous in grade as in cotton, and that the Crushers' Association and the minor associations that contribute to it are as necessary as the Cotton Exchange or the Board of Trade. I know nothing of the oil mill business prior to 1900, but since then I am prepared to prove that the oil mills have not made a profit commensurate with the investment. Take the Hamilton mill that cost $150,000, that buys annually 11,000 or 12,000 tons of seed. This would require a capital of $225,000. It has never made 20 per cent on that investment any single year, nor has it averaged 10 per cent on actual cost of mill. Think you this is a tempting proposition? How many of you in this audience make as much as $2 per ton on your less fortunate neighbors or labor? and yet not one dollar have you invested in mill, and the mills will and actually do furnish the money to many of you to buy with. No, gentlemen, the mills are prepared and anxious to take you into their combination, but on principles of equity and fairness. We had a trade with your Association last year, whereby you planters assisted in making the price on seed. The same proposition was made to them this year, based on a $2 per ton margin, and you turned it down."

Mr. W. E. Glassell, President of the North Louisiana Cotton Planters' Association, asked and received recognition to make a statement relating to the above assertion. He said that the gentleman who was reading a paper alleged to be entitled "The Oil Mills' Interest in the Boll Weevil," had stated the truth about the proposition, but had not gone far enough. Mr. Skannal had made the proposition to him, who had the honor to be President of the organization, and he told him that he could not accept the proposition, but would have to bring it before the Executive Council of the Association, and requested the oil mills to reduce the proposition to writing, which he would submit to the Council as soon as he could call them together. This placing the proposition in writing was never done, for what reason doubtless Mr. Skannal and the oil mills best knew.

Mr. Skannal, continuing, said:

"The ravages of the boll weevil in Texas has made conditions distressing out there. Numbers of mills with few seed to crush, thousands of cattle everywhere thrown upon the market with no feed, has created a condition for the last few years that was extremely profitable to Louisiana planters, but some of the mills are now in the hands of a receiver and normal conditions now prevail throughout the seed territory. Yet we are prepared to meet you tomorrow on fair and equitable grounds, and unless you concede it you must take your medicine like men when conditions fall against you, but these are matters that will adjust themselves, and it behooves both the mills and the planters to let better counsel prevail and go hand in hand with you to a mutual and binding prosperity. If this is not done and your one-sided policy prevails, the weaker mills will be bankrupted and taken possession by the big refineries. You will then have cause to howl.

"In order to avoid these conditions the most conservative counsel should prevail. I desire now to urge upon you the cultivation of these amiable qualities, the root of which is found in your educational system, and as our children are the dearest objects of solicitude to every parent, it may not be amiss to call attention to the approaching election, in which you will be called upon to pass sentence on the bond scheme, and in such a way as to reflect credit on your own posterity. What is dearer to us than our children? How can they be ornaments to society and leaders in the enterprises of right without proper educational advantages? We now and then find a man whose natural ability forces him to the front, but there is every reason to believe that when these natural talents are polished and refined by education they become irresistible. We all learned at school when we were boys that the square described on the hypotenuse of a right angle triangle was equal to the sum of the squares described on the other two sides. We drew the triangle on our slates and constructed the square on each of the three sides, and found out what that meant, but it never occurred to me that there was a triangle in a negro cabin until I got to be a farmer, and tried to cut the rafters for a cabin. I soon discovered that half the width of the cabin for a base and the heighth of the roof for a perpendicular, gives you two sides of a triangle and that the rafter connecting these two points was the hypothenus. I had only to square the base and perpendicular, add them together and extract the square root, and you had the length of your rafter. It at once came home to me that I was a carpenter.

"This illustrates one of the very primary principles of education. They continue to crop out and serve the individual in proportion to his attainments. There is a further advantage in education to the individual that surpasses all others, the direct pleasure that each individual enjoys from it. Take a sheet of music, hand it to a man ignorant of music and you can imagine the feelings of a thick headed negro who didn't know B from bull's foot, looking at a book upside down; but hand the same sheet to an educated musician and immediately there is produced in his mind all the inspiration that music can give. Imagine a Frenchman, who could not read English, lost in an island with an English library at his side; innocuous desuetude. Or an Englishman with a Greek edition of Homer's poems; but these are attainments no longer necessary, but they are elegant accomplishments to any individual. But attainments within the reach of all is a plain, comprehension of the English language. to write it correctly and read it fluently and intelligently. This requires careful training and study. I remember when a boy the impressions made on me when I first read *Romeo and Juliet*. the beauty of the girl and the love making was all that caught my boyish fancy, and I continued to think of it whenever the play was mentioned in the same light, until some weeks ago my attention was directed to the play, by some extremely favorable comment by McCauley, I resolved to read it again. I found the same love scenes that appealed so much to me when a boy, but the characters were more developed. Juliet was all beauty and grace and loveliness, but she was absolutely the purest and most lovely woman of a long line of illustrious ancestors. Romeo was likewise all for a man that she was for a woman, and belonged to an equally illustrious family. These two families, the Montagues and Capulets, hated each other with a venom for years, so when these two ideal creatures met and fell in love, there was a reaction from hatred, all barriers were torn down and the pent up hate of both families congealed into the most perfect love the world has ever known, but their marriage was not to be; both were to die as a sacrifice that the two families might be brought together over their graves. This is the history of the Christian religion. If you are to offer a sacrifice, let it be in the interest of your children, that those of them who have the ability may be leaders of men, that the less gifted may be useful citizens, and that all, when the active days of life are over and old age is creeping upon them, may find lasting pleasure in the choicest of books, and not sit from 60 to 80 in a big arm chair, half deaf, half blind, in a perfect state of innocuous desuetude.

"So let the mills and planters, whose interests are mutual, stand together; let us all unite our forces against the boll weevil pest, let every politician bury the hatchet and let every good man in Louisiana remember when he goes to the polls on Tuesday next that education is the only power that can rescue innocence and purity from sacrifice."

At the conclusion of Mr. Skannal's paper, Editor Blackwell, of the *Cotton and Cotton Oil News,* of Dallas, in commenting on the same, urged a better and more liberal feeling between the mills and the planters, stating that the feeling in Texas between them was most amicable, and he knew and the farmers of the State of Texas generally knew that the mills had paid and were paying all that the seed were worth, considering the low price of the manufactured product.

Mr. R. E. L. Giles, Secretary of the North Louisiana Cotton Planters' Association, said that this might be true of Texas and Texas mills, but he desired to inform the able young editor of the

News that Texas mills were paying more for seed in Louisiana than were the local mills.

Mr. Blackwell was surprised to hear this, and said he could not understand how they did it.

Mr. Giles—Well, sir, it is a fact, and while I do not think this the proper time, place or occasion to bring in what my friend, Mr. Skannal, has been pleased to term "the strained relations between the mills and planters," at the same time, since he has done so, I desire to state here and now to you, and to others who may be interested, that it is a fact that the members of our Association shipping over the Texas & Pacific Railway have this season sold from one to ten cars each to Texas mills at from $1 to $2 a ton more than was offered by the local mills. How they do it I am not supposed to know, but it may be the result of better management, or something of that kind.

Mr. Walter F. Buck, of the Western Bank & Trust Company, of Dallas, represented D. A. Templeton, the Vice President of the bank, who was on the program to read a paper on the subject of "The Boll Weevil Situation from a Texas Banker's Standpoint," and who was unable to attend the convention. Mr. Buck said:

"In 1902 our branch office had large accounts out in the boll weevil district. We were unable to collect the accounts during the year, but we were able to put them in shape and adjust them and now more than 90 per cent have been collected. During the present year we have large accounts in the boll weevil district, but we have our business in such shape that we feel confident that our losses will be less than 1 per cent. We are not afraid of the boll weevil, and we solicit business. I believe that what you need is not less of the boll weevil, but more confidence in your people to combat with them. Do not keep your money locked up, but be liberal and help your people in this calamity. Your farmers deserve your help; they need your education.

"It is our policy to instruct our customers as much as possible in methods of better farming. We have sent to them bulletins from the Department of Agriculture at Washington and have subscribed for 2,000 copies of *Farm and Ranch.* To my mind this has better effect in educating our customers than anything else.

"We also get out circular letters to our customers and farmers in general. This is a copy of the letter that we get out. (Reads copy of letter)."

Captain Johnson inquired:

"When the boll weevil exterminates the crop, what do you do?"

"We encourage diversified crops and take a security on other crops."

"How much real estate have you had to take hold of?"

"Very little. We have not closed any farm mortgage."

"What rate of interest do you charge?"

"Our regular rates are 8 and 10 per cent."

"How much land does this bank own?"

"None, except on what our house stands."

"How many years have you been doing business in the boll weevil district?"

"Our business has been in existence more than five years. The boll weevil has been in our district two years, and in some sections three years."

"What proportion did you collect the second year?"

"I do not know exactly. We encouraged the people to plant other crops—some corn, etc.—so their losses were not so heavy."

"What do you estimate their loss will be this year?"

"Less than 1 per cent. Of our old business there was $500,000, and we collected 90 per cent. Our new business is on better basis. But we were well pleased to collect the 90 per cent. Some of the farmers who owed money three years ago, now are able to hold their cotton and are independent."

"Do you consider this due to diversity of crops, or victory over the boll weevil?"

"Well, we consider that we have had many things in our favor this year—the weather, diversification and use of the cultural methods.

"When a customer applies for, say $500, we usually let him have $300. We insist on their living on smaller amounts."

"Where your customers have been raising three-fourths of a bale to the acre, what do they make now?"

"In Ellis County they have been making three-fourths, and are now making half a bale—that is the average. In Dallas County they are making half a bale on farms that formerly made three-fourths."

"Where your customers have cotton killed, do they plant over again?"

"Yes, where circumstances are favorable, they do."

"Do your customers use Paris Green?"

"There is practically no Paris Green used."

"How much have your lands depreciated in value?"

"They have not depreciated at all. You can not buy land any cheaper there now than you could two years ago. That is in Dallas County. Now, in Limestone County they did. Farms were offered for sale for three-fourths their value, and in one instance a farm was offered for half its value, but there was not much market for these lands. In Dallas County the farmers are preparing to plant as much cotton next year as in the past. The bank, however, preferred that they plant cotton on less land, and attend to it, believing that a larger crop would be raised as had been raised on larger acreage."

Upon motion of Mr. Foster, that Mr. Buck and the banking institution with which he was connected be tendered a vote of thanks, the motion was unanimously carried by a rising vote.

The following paper was submitted by C. C. Hooper, member of the Texas Boll Weevil Commission:

"Taylor, Texas, Nov. 2, 1904.

"Hon. H. A. Morgan, Secretary Crop Pest Commission, Shreveport, La.

"My Dear Sir: I am in receipt of your favor in which you invite me to be present at your annual convention, and regret very much to have to say that a previous engagement will deprive me of that pleasure.

"The subject in the discussion of which you have invited me to take part, 'The Cotton Boll Weel from the Standpoint of a Texas Farmer,' is one of vital importance to every citizen of your great state, whatever be his vocation, and, while I am unable to be with you in person, I will give you briefly my views upon the subject.

"You sometimes hear men in this State say that the boll weevil is a blessing in disguise, arguing from the rise in the price of cotton occasioned by their ravages, but any one who has gone around over Texas as I have and seen the abject poverty and suffering which they have caused in the districts of Texas worst affected, will conclude that if they are a blessing, then they are one *very much in disguise.* I have never been able to see where those in the infested territory were benefited by this pest unless it is necessary to keep a man poor in order to make him good, and I believe that one would have to have the patience and fortitude of Job in order that his moral or spiritual nature should receive and benefit from a battle with boll weevils.

"I do not think that I am an alarmist, and hope that I will not be considered as such, but it seems to me that unless something unforeseen happens, the entire group of cotton producing States will become affected to a greater or less extent by this pest, and your State being only separated from ours by an invisible line, and the climatic conditions there being exceedingly favorable to the propagation of the boll weevil, you will, in my judgment, be the ones next seriously affected, and, if this should be the case, unless the best methods of combating the evil are employed, you will find the entire business interests of your State affected to an extent much greater than you can now possibly conceive of. Some idea of the extent of the damage done by the boll weevil can be obtained by examining the ginners' reports from the sections of this State affected, from which it will be found that the cotton production of those counties, taking them as a whole, has been decreased fully 50 per cent. Those counties recently infested have not felt the effects so keenly, but where the struggle has been going on for a number of years, the terrible destruction done by them is fully appreciated, and property values have decreased greatly. If the problem had been understood to be so serious when only a few counties were affected, and it had been handled properly, we might have succeeded in exterminating the weevil at small cost, comparatively speaking, and I sincerely trust that your State will be successful in the vigorous effort which it is making in trying to prevent the serious infection of the State. With us the period of *prevention* is passed, and the problem which now confronts us is: How can we profitably raise cotton in spite of the boll weevil? The reward of $50,000 offered by our State Legislature at its last session for the discovery of a means of eradicating the boll weevil, together with the gravity of the problem itself, has stimulated the inventive genius of our people, both in the line of mechanical and chemical means of destruction and cultural methods of combating, and means of each kind have been found which are unquestionably beneficial, but I am convinced after four years' of exeperience and careful observation that what is known as the cultural method is by far the most economical and sure way to make cotton in spite of the boll weevil yet advanced by any one. This method is in brief as follows: In the Fall of the year and as early as possible gather together and burn all cotton stalks, corn stalks and other growth on the farm in which insects could hibernate, in fact, *clean up the farm thoroughly,* and do this as early as possible after the crops are harvested. Prepare the land for cultivation by deep plowing during the Winter, and plant early maturing varieties of cotton, and plant as early as the climatic conditions and condition of the soil will permit. When the plant is about twenty days old, thin to a stand and cultivate intensely by plowing as often as every two weeks until cotton begins to open, but *plow shallow each time.* It is well, also, to use fertilizers where they will hasten the maturity of the plant, and, in any event, upon poor land. The crop which has just been harvested in Texas demonstrates that, where the plan of intense cultivation above outlined has been closely pursued, a fairly good cotton crop can be raised, in spite of the boll weevil, but, of course, at a much greater expense in cultivating than was formerly necessary, and rendering the amount of cotton which can be cultivated by any one farmer much less than formerly, and thereby making greater than ever the necessity of an intelligent diversification of crops.

"Trusting that your meeting may be fruitful of much benefit to your State, I am,

"Yours very truly,
"C. C. HOOPER,
"Member Texas Boll Weevil Commission."

Chairman Glassell, of the Committee on Organization, submitted the following report, which was adopted by unanimous vote:

"*Mr. Chairman:*

"Your Committee on Organization begs leave to submit the following report:

"WHEREAS, We feel that the value of the Louisiana Boll Weevil Association, organized in New Orleans last December, the second successful meeting of which is drawing to a close, has been fully demonstrated, and that we appreciate the faithful and unselfish work done by our worthy President; therefore be it

"*Resolved,* That it is the unanimous voice of this Committee that we continue this organization and re-elect Col. Charles Schuler as President; as Vice Presidents, Messrs. F. L. Maxwell, H. C. Stringfellow, J. Alphonse Prudhomme and Henry Von Phul; as Secretary, R. E. L. Giles."

RESOLUTIONS ADOPTED.

The following resolutions, reported by the Committee on Resolutions, through its Chairman, W. L. Foster, were unanimously adopted:

"WHEREAS, We are reliably informed and believe that efficient data has been obtained by the Louisiana experiment station for the restriction and final eradication of the deadly cattle tick, *boophilus annulatus,* from the State, therefore be it

"*Resolved,* That we request the State Crop Pest Commission to issue such information as will enable the farmers of the State to eradicate from their pastures this terrible pest; and be it further

"*Resolved,* That to the progressive press of this city, the Shreveport *Times* and the Shreveport *Journal,* for the splendid and complete reports of the important work done by the convention, the sincere thanks of the convention is hereby tendered the able and clever management and reporters for their courtesy and consideration."

Before adjourning the convention Colonel Schuler tendered his sincere thanks to all who had participated in and made the convention a success.

The convention adjourned at 9:10 o'clock, subject to the call of the President.

APPENDIX.

PROF. J. H. CONNELL'S ADDRESS.

When the afternoon session of the second day of the convention was called to order, President Schuler introduced Prof. J. H. Connell, editor of *Farm and Ranch*, of Dallas, Texas, who addressed the convention as follows:

"EFFECT OF THE BOLL WEEVIL ON THE TEXAS COTTON CROP.

(J. H. CONNELL, Editor *Farm and Ranch*, Dallas, Texas.)

"Texas will make a fair crop of cotton this year, though it will prove a small crop in proportion to the area planted. The boll weevil has left its mark upon the cotton fields, especially in South Texas.

"It is with the hope of preparing the minds of the cotton growers of North Louisiana for the coming of this pest that I accept a place upon this program, and while I hope to stick to my subject during this discussion, I will adopt as a second title: 'Set Your House in Order, Louisiana.'

"In what way does the boll weevil affect the interests of a Texas county? How does it influence labor? In what light is the weevil regarded by the merchant? What is its final effect upon the business centers? Does it frighten away negro and other tenant labor? Is the pest more destructive upon certain soils than others? What will be the work of the weevil in Louisiana compared with its achievements in South and Central Texas? Familiarity with the work done to suppress the weevil during the past ten years, combined with some study of the pest in the cotton fields since 1895, is my excuse for appearing before you upon this occasion.

"One of the speakers here this morning eulogized the boll weevil for the service it has rendered the cotton planters. The boll weevil has been pictured as 'a friend in disguise.' This may be, Mr. Chairman, but permit me to say that the disguise is most perfect. So perfect that the best friend of the farmer can not detect a line of benevolence in the ugly visage of this pest. He is a friend at whose approach trade collapses, and in whose wake women and children cry for bread. If such a creature is a friend of the cotton farmer, we should all pray that the cotton grower shall be delivered from his friends.

"Glance for a moment at the decrease in cotton production in ten of the typical boll weevil counties of Texas, and compare with the amount of cotton ginned in the non-infested counties during the same season. (Taken from United States Department of Agriculture):

No. 1.—Types of Infested Counties.

Counties—	1899.	1900.	1901.	1902.	1903.
Austin	31,000	10,000	15,000	15,000	15,000
Bastrop	40,000	35,000	22,000	20,000	11,000
Bee	4,000	12,000	8,000	5,000	7,000
Brazos	22,000	18,000	20,000	15,000	15,000
Burleson	25,000	16,000	17,000	12,000	16,000
Caldwell	47,000	44,000	25,000	23,000	18,000
Freestone	20,000	29,000	20,000	31,000	3,000
Lee	21,000	10,000	11,000	11,000	5,000
Limestone	47,000	62,000	47,000	56,000	17,000

No. 2.—Counties Not Damaged By Weevils.

Counties—	1899.	1900.	1901.	1902.	1903.
Brown	12,000	28,000	8,000	11,000	24,000
Cass	15,000	21,000	19,000	19,000	19,000
Collin	49,000	70,000	60,000	47,000	62,000
Comanche	23,000	47,000	23,000	34,000	42,000
Dallas	41,000	59,000	40,000	46,000	53,000
Ellis	86,000	126,000	79,000	85,000	107,000
Grayson	40,000	63,000	67,000	54,000	59,000
Lamar	49,000	89,000	56,000	59,000	47,000
Montague	15,000	34,000	28,000	16,000	30,000

"This is sufficient to show at a glance why one-half of the stores have closed in certain counties in our State. Why railroads have decreased the force of conductors and brakemen during the fall season in badly infested regions, instead of increasing such forces, as is the custom.

"ITS EFFECT UPON INDIVIDUALS.

"While the weevil is not a respector of person, he does not treat all farmers alike. In some counties we will find a man gathering a bale of cotton per acre, while his neighbor a short distance away gathers one bale to twenty acres. There are many conditions that go to influence and control the result which I have not now time to discuss, but will mention them in brief. The unfavorable conditions for cotton in boll weevil districts are (1) naturally moist land, (2) heavy rainfall during the Summer, (3) abundant brush and timber in which to harbor during the Winter, (4) late planted cotton and other conditions that may retard growth. Since these conditions may vary widely within short distances, we may readily understand why it is that many fail to grow cotton in the boll weevil district and some others succeed. This will help you to understand also why a given neighborhood in a certain county will suffer freely from weevil one season, and appear to be almost exempt the next. Nevertheless, the influence of the weevil upon Texas cotton is to render the crop very uncertain from year to year, which results in breaking down established trade conditions and destroying business confidence.

"The small farm owner at the end of three or four years is forced to rely in a large measure upon his poultry, his live stock and shipments of fruit and truck. The tenant farmer is in many cases driven from the community because of the uncertainty of the only crop with which he is thoroughly familiar. We might give numerous examples in support of this position, but all familiar with the general features of the case will recognize that the statement made is but the logical outcome of the conditions described.

"THE WORST RESULTS.

"Throughout North Texas the Winter is much more severe than from Waco south. Many of the weevils are absolutely destroyed during the Winter season while in a hibernating state. Because of these severe Winters the weevil has not proved so very destructive in counties north of the Texas & Pacific Railroad running east and west through Dallas, though infestation occurred two years since in parts of this region. It is commonly stated that the weevil advances at the rate of fifty miles per annum, but it is quite certain that in its northward march the spread of the weevil has been checked by Winter conditions. The County of Dallas and neighboring counties have been lightly infested for two or more years, but Ellis county, which is south of Dallas, produced over 100,000 bales of cotton last year, which indicates beyond all question that the weevil was not very destructive in that section. The immunity enjoyed by certain counties in North and Central Texas is also due to the absence of woodlands. Broad prairies are characteristic of such counties as Ellis, Dallas, Hill, Collin and others. Here hibernating conditions are unfavorable, there being no natural protection from woodland except along the river courses and creeks. But in certain East Texas counties where woodland is abundant, the Winters mild, the rainfall during Summer heavy, the ravages of the weevil are at its worst. The conditions are almost or quite as favorable for weevil damage in extreme South Texas where weevils stay in the field during the entire Winter and the death rate among hibernating weevils is slight.

"Many farmers in these two sections of Texas failed to make a bale to twenty acres of land planted and cultivated in cotton during the present season. The conditions described by Mr. S. E. Barnes, of Trinity, Texas, in a recent communication published in *Farm and Ranch,* affords a clear description of the ravages of the weevil under favorable conditions. He there reaches the conclusion after years of fighting the pest that it is useless to plant sandy lands to cotton, located within one or two miles of timber belts. The conditions prevailing in East Texas are virtually the same as those existing in North Louisiana, namely: Mild Winters, heavy Summer rainfall and an abundant supply of timber in which the weevil may Winter. These conditions suggest that something more than cultural methods and the use of Paris Green may be necessary for the protection of North Louisiana cotton during those years in which average climatic conditions prevail."

824

CIRCULAR NO. 3

OF THE

State Crop Pest Commission of Louisiana

The Remedy for the Boll Weevil

A Brief Discussion of the Steps Necessary to Produce a Profitable Crop of Cotton in Sections Infested with the Boll Weevil, by means of the "Cultural Remedy."

BY

WILMON NEWELL

Issued by the State Board of Agriculture and Immigration.

J. G. LEE, - Commissioner

SHREVEPORT, LA.
CASTLE PRINTING COMPANY
1905

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State Crop Pest Commission of Louisiana

ORGANIZATION

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Baton Rouge.

HON. J. G. LEE, Commissioner of Agriculture, Baton Rouge.

PROF. W. R. DODSON, Director of the Louisiana Agricultural
Experiment Stations, Baton Rouge.

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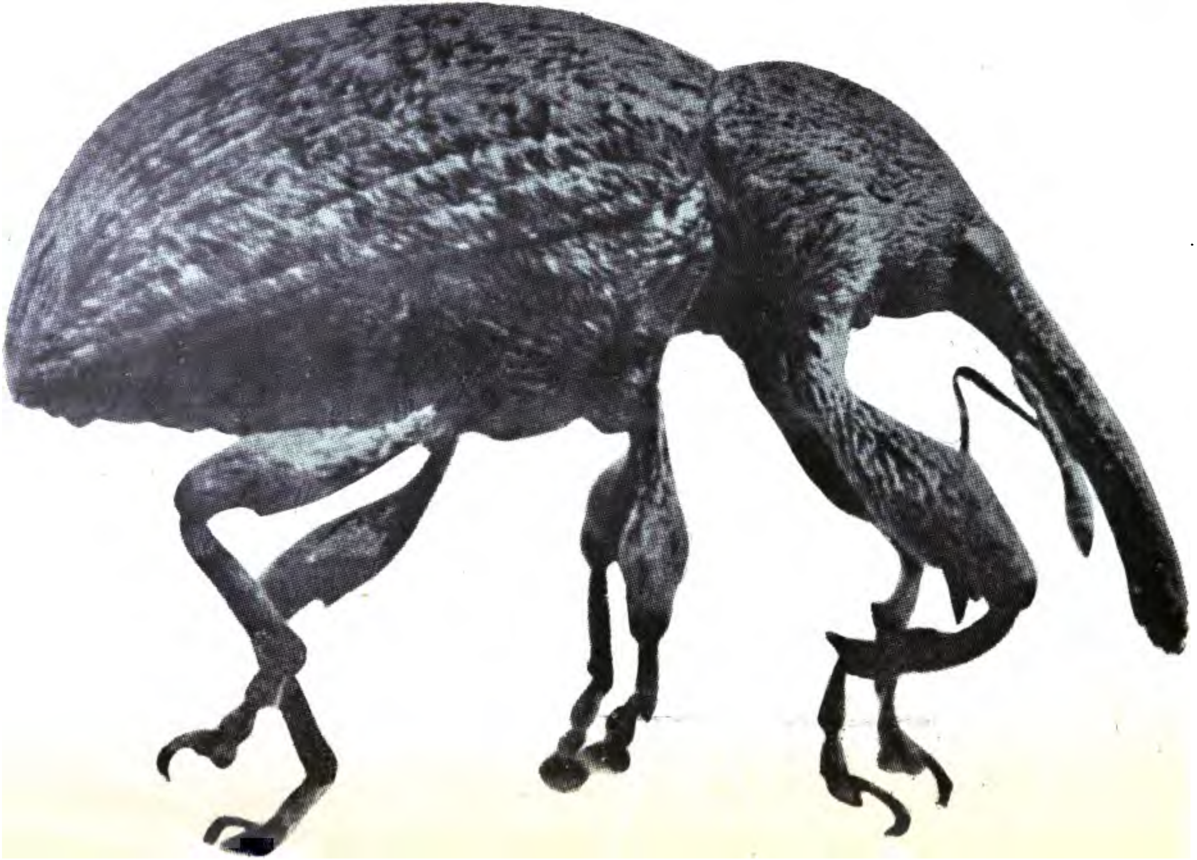

FIG. 1—Mexican cotton boll weevil (*Anthonomus grandis*), greatly enlarged (After a photo by E. D. Sanderson).

State Crop Pest Commission
Of Louisiana.

CIRCULAR No. 3. *NOVEMBER 1905*

The Circulars of the State Crop Pest Commission are sent free of charge to all farmers and fruit growers of Louisiana who make application therefor.

THE REMEDY FOR THE BOLL WEEVIL.

BY WILMON NEWELL.

Although the Crop Pest Commission of Louisiana contemplates publishing a full and complete report upon the investigations made in connection with the boll weevil during the past two seasons, giving the results obtained by extensive and quite conclusive experiments with both Paris green and the cultural measures, it appears advisable to issue at present a brief circular of information regarding the main steps embodied in the cultural remedy.

The compilation and illustration of the larger report referred to, will of necessity be delayed until the season's field work has been completed, which will not be prior to January 1, 1906, and after that date the preparation and distribution of the bulletin will require several weeks of work. It is the desire of the Commission to place accurate information in the hands of all the farmers in the weevil-infested territory at as early a date as possible, especially as the weevil, by its migratory flight eastward, has occupied considerable territory in which it has not heretofore been known, and in which the farmers have had no experience or instruction in the methods that must be employed to successfully produce cotton in spite of this pest.

The majority of progressive farmers plan their season's work several months in advance, and in the boll weevil section, the farmer will find it advisable to have a thorough knowledge of the cultural remedy in order to properly plan his work for the season of 1906. For this reason the present circular is issued, to be followed later by a more complete report.

The territory in Louisiana, occupied by the boll weevil up to December, 1904, is shown by Fig. 2. The territory occupied by the weevil in the early summer of 1905 is shown by Fig. 3. It will be noticed that the infested territory decreased considerably following the long wet winter, the weevils being apparently completely exterminated in the eastern portion of the territory gained by them in the fall of 1904. It is worthy of note, however, that all of this territory lost by the insects was territory which they did not enter until after about September, 10, 1904, and in which, therefore, they did not have time to breed up to considerable numbers before the arrival of frost. In Western Louisiana, where they had an opportunity to breed through the greater part of the season, many survived the winter successfully. Even should the winter of 1905-1906 be fully as wet and severe as the one of 1904-1905, the weevils may be expected to survive in considerable numbers in a much larger area than they did last winter. The winters cannot be de-

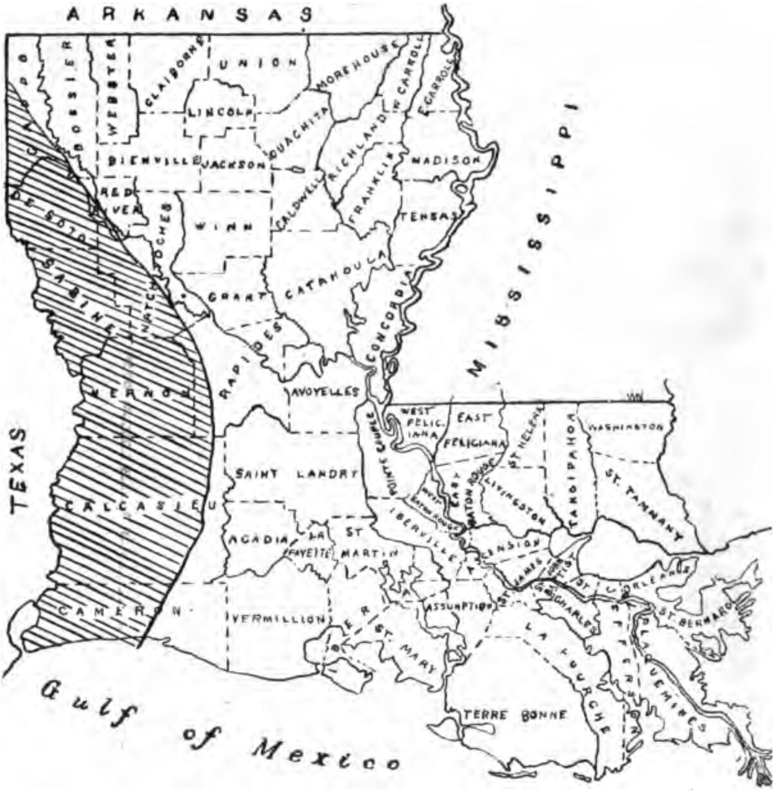

FIG. 2—Area (shaded) in Louisiana, infested by the boll weevil in December, 1904.

pended upon to solve the boll weevil problem in Louisiana, and there is nothing to indicate that the weevils will not survive the winters in Louisiana in as great numbers as they do in Texas.

In spite of the loss of territory by the boll weevil, during the past winter, they have made a marked gain to the eastward by their migratory flight, which began during August and continued until the early part of November, decreasing in volume and extent with the approach of colder weather. This migratory flight regained for the insect all of the territory which it had lost and a considerable area in addition. The distribution of the weevil in Louisiana, and the territory occupied by it at the present time, is shown by Fig. 4. Although the net gain in territory by the insect since December, 1904, has not been nearly so great as was feared, nevertheless this gain includes about four-fifths of the Red River Valley of Louisiana,

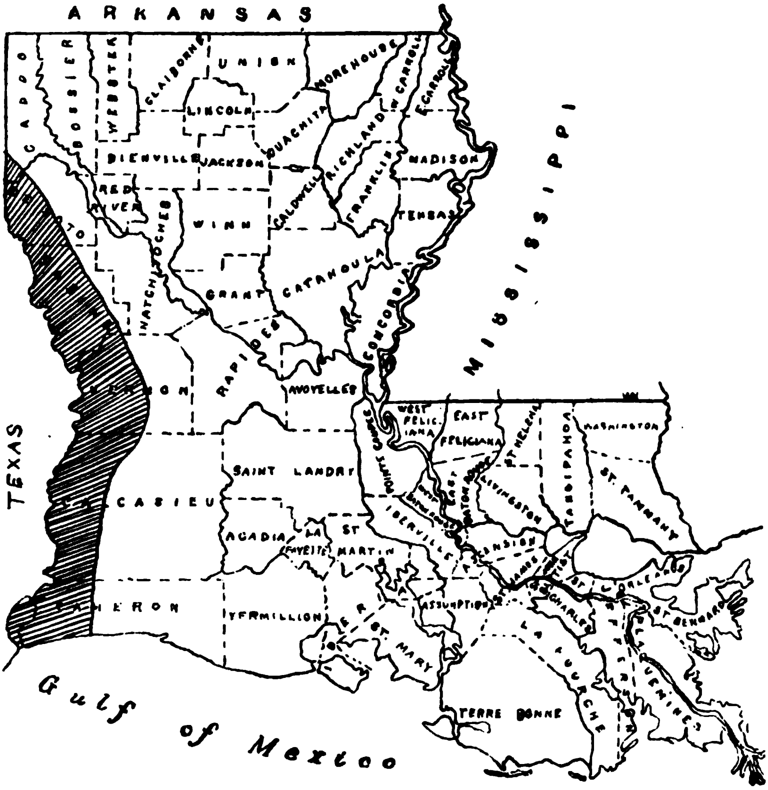

FIG. 3—Area in Louisiana infested by the boll weevil in July, 1905.

one of the richest cotton-producing sections of the South. About one-fifth of the cotton-producing territory of the State is now infested by the boll weevil, but the infestation in at least 30 per cent of this area is at present so light that excessive damage by the boll weevil cannot be anticipated the coming season. In spite of this fact, however, the application of the cultural remedy next year in the territory now but lightly infested is of as much importance as in the heavily-infested territory, in order to reduce the weevil damage that will be threatened in 1907. More particular reference to this will be made below.

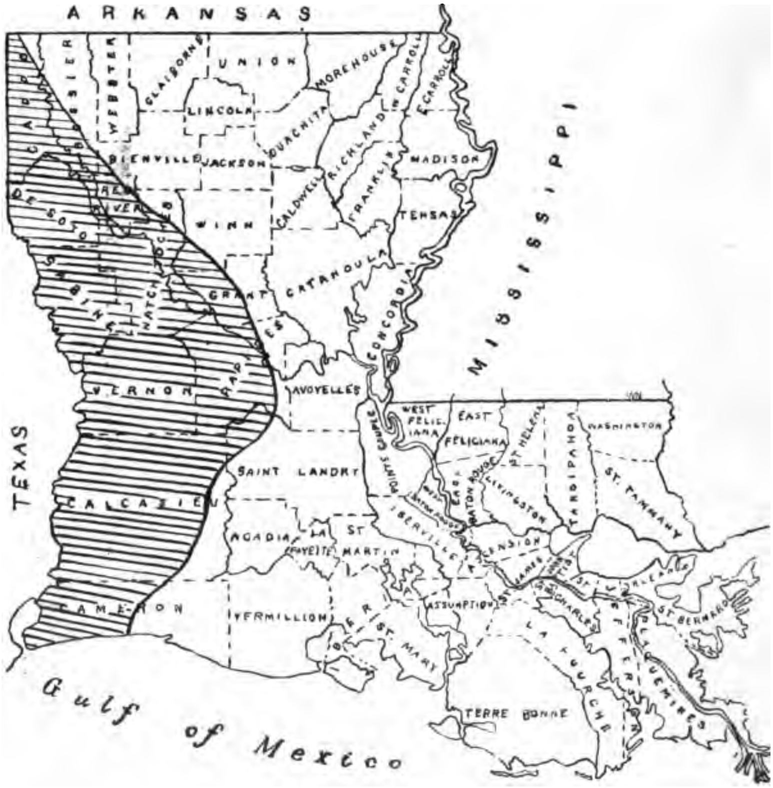

FIG. 4—Area in Louisiana infested by the boll weevil in November, 1905.

THE CULTURAL REMEDY.

Ever since the appearance of the boll weevil in Southern Texas in 1892, the efforts of the United States Department of Agriculture and of the officials of the State of Texas have been directed towards finding a remedy for the insect. Every suggestion that offered any possibility of being developed into a remedial measure has been thoroughly tested, and the life history and the habits of the boll weevil have been thoroughly studied by the best entomologists in America. At the present time more is known regarding this insect than regarding any other of the thousands of insects which occur in this and other countries.

As a result of the exhaustive investigations and experiments carried on by the United States Department of Agriculture, Bureau of Entomology, under the able direction of Dr. L. O. Howard and Prof. W. D. Hunter, the "cultural method" of avoiding the greater part of the boll weevil damage, thereby producing profitable crops of cotton in defiance of the boll weevil, was devised. It is very probable that the cultural methods will, by further experimentation, be developed to greater effectiveness than at present, and the majority of intelligent planters have now come to realize that in the cultural method, or "cultural remedy," lies the only true remedy for the boll weevil. In view of the numerous experiments that have been made, both by entomologists and planters, and in view of the very complete knowledge of the weevil now possessed, there appears no possible chance of any remedy, aside from the cultural remedy, ever being found. Even the "quacks" and "patent" remedy agents, who, a few years ago, sold the farmers thousands of dollars' worth of so-called boll weevil "remedies," have given up hope, and have, for the most part, disappeared.

In the cultural method lies the only real remedy for the boll weevil, and for that reason we prefer to call it by its right name—i.e., the "cultural remedy."

For its successful application the cultural remedy requires: (1) early planting; (2) the use of a quick-maturing variety of cotton; (3) judicious use of fertilizers on soils requiring them; (4) thorough cultivation; (5) destruction of cotton plants in the fall, three to five weeks before the first killing frost, and (6) diminishing the number of favorable hibernating quarters. These measures are referred to more in detail below.

I—Early Planting.

The central idea upon which the cultural remedy is based, is that of producing a crop of cotton before the boll weevil becomes abundant enough to destroy all squares as fast as they are formed by the cotton plants. As only a small per cent of the weevils entering hibernation in autumn, survive until the following spring, there are not sufficient weevils in the fields in early spring to cause any perceptible damage. Their rate of increase is, however, so great—being in excess of fifty-fold for each successive generation*—that by the middle or latter part of August the weevils have usually become abundant enough to puncture (and hence prevent the development of) every square. The advisability of early planting must therefore be self-evident.

The cotton should be planted just as early as possible, even if some slight risk is taken of a late frost necessitating a second planting. The advantage to be gained from an extra early planting is sufficient to far more than compensate for the work and cost of an occasional second planting as the result of an unexpected late frost.

Lands which are not subject to severe washing should, whenever possible, be plowed with the turning plow in the fall so they will be in the best possible condition for early spring planting and for rapid germination of the seed. Aside from the advantage of this fall plowing with relation to the boll weevil, it also serves to destroy large numbers of the boll worm (an insect entirely separate and distinct from the boll weevil), which in most years is responsible for a large amount of damage to the Louisiana cotton crop.

II—Early Varieties of Cotton.

For early planting in boll weevil sections, "King" cotton has been found most satisfactory. "Rowden" is preferred by many farmers on account of the staple being more in demand than that of "King" and Rowden, during the present season has been reported as giving very satisfactory results. "Shine's" is also a good variety for use where an early crop is desired.

Prof. W. D. Hunter, of the Bureau of Entomology, reports that the "Triumph" variety, originated by Mr. A. D. Mebane, of Lockhart, Texas, has yielded on the black lands of Texas, with boll weevils present, to exceed 1100 pounds of seed cotton per acre. It is not unlikely that this variety will be found well-adapted to some of the similar Louisiana soils. "Parker" cotton, in the experiments conducted by the Bureau of Entomology, United States Department of Agriculture, has also given good yields in the boll weevil infested sections of Texas, but has not been found quite as productive as King.

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*Hunter & Hinds, Bulletin No. 51, Bureau of Entomology, p. 97.

Regardless of which early variety is decided upon by the farmer, he should exercise extreme care in purchasing seed, in order to guard against mixed seed, or seed which is sold under a misrepresentation. Owing to the large demand for "King" during the past two seasons, several unscrupulous parties in the eastern part of the Cotton Belt have sold ordinary native seed at high prices, representing it to be the pure King seed.

If seed is purchased through well-known and reputable seed houses there will be little difficulty from this source. Regardless of where the seed is purchased, the buyer should insist upon receiving with it a written guarantee of its purity.

The Commission expects to compile, during the coming winter, a list of Louisiana farmers who have comparatively pure King or Rowden seed for sale, this list to be furnished to those who apply for it.

The Commission will not advertise or guarantee anyone's seed, but no planter will be included in this list until the Commission is satisfied regarding the purity of the seed he has to sell, the conditions under which it is grown, etc. Farmers wishing to receive this list, as well as those who have seed of either of these varieties for sale, should communicate with the Crop Pest Commission at Shreveport.

III—Use of Fertilizers.

The use of fertilizers in connection with the cotton crop seems not to be universally practiced in Louisiana. Upon the upland soils and upon light sandy soils, the use of a "complete" commercial fertilizer has been found profitable and has been found to materially hasten the development and maturity of the crop. In cultural experiments carried on in Sabine Parish this season by the Crop Pest Commission, the application of 200 pounds per acre of "8-2-2" commercial fertilizer prior to planting gave excellent results, in spite of the fact that severe washing rains followed for several days after the fertilizer was applied, and it was thought that most of it had been leached out.

On botton lands, the need for fertilizer is not so evident, but even here the use of a fertilizer containing a considerable amount of available phosphoric acid is found to hasten maturity to a considerable extent, and in sections badly infested by the boll weevil, nothing should be neglected which will be conducive to early maturing of the crop. On most of the alluvial lands, nitrogenous fertilizers are not needed, and indeed are for the most part undesirable, as nitrogen tends to make a luxuriant growth of the plant at the expense of early fruitage. Luxuriant plants furnishing an abundance of shade and moisture are conducive to the rapid development and increase of the boll weevils.

IV—Thorough Cultivation.

The effect of thorough cultivation is to keep the plants growing continuously and to increase the formation of bolls and hasten their maturity. One chopping and three cultivations cannot be considered "thorough" cultivation. The ideal cultivation is one which results in a "dust mulch" being maintained in the field throughout the spring and early summer. As conditions vary to a great extent in different sections of the state and upon different soils and plantations, a hard and fast rule regarding what constitutes a "thorough cultivation" cannot be laid down. In general, however three choppings and about five cultivations will result in rapid development of the plants and in hastened maturity.

Upon many farms and plantations in Louisiana the cultivation of the cotton crop heretofore has been virtually as good as it could be under any conditions, and very little if any improvement in the care of the crops could be made. Upon the majority of farms, however, thorough cultivation has not been practiced, and especially is this true where the tenant system has been employed, and where plantation managers themselves have attempted to cultivate the largest possible acreage with the labor at their command. Upon such plantations there must be a reduction of the cotton acreage in proportion to the labor employed, to the point where the crop can be thoroughly cultivated and cared for. Hard and fast work to make a "quick" crop must be the motto in heavily-infested boll weevil sections.

V—Fall Destruction of Cotton Plants.

This is by far the most important step in the cultural remedy. The steps enumerated above—early planting, use of quick-maturing varieties, judicious use of fertilizers and thorough cultivation—all have as their object the production of a crop before the boll weevils become abundant. Of actual means by which the boll weevils themselves may be destroyed, we have but two that are practical—the fall destruction of the cotton plants and decreasing the number of favorable hibernating quarters. Of these two, the latter is of only small importance compared to the destruction of the cotton plants.

As was stated on a previous page, but few weevils succeed in surviving the winter and even in the most heavily infested sections it is difficult to find weevils in the cotton fields when the cotton first appears above ground in the spring. As a result of careful laboratory studies, combined with field observations, Messrs. Hunter and Hinds have found that the progeny of one pair of hibernated weevils amounts, at the end of the first generation, about June 29th, to 100, and the progeny of these weevils, by the middle of August, amounts to 5,000. The third generation, becoming adult about the third week in September, in turn produces a total of 250,000 as the progeny of the 5,000, provided a sufficient number of squares and young bolls are present in the field*.

In reality a state of "gross infestation" is usually reached about the middle or latter part of August, every square at that time being punctured, either for egg deposition or for feeding. From that time on the increase in the number of weevils is limited only by the available supply of green squares, forms and young bolls. Could the cotton plants produce squares fast enough, the progeny of a single pair of hibernating weevils, by December 1st, would be at least 15,000,000, by the most conservative calculation.

It will readily be seen therefore, that with a supply of food available late in the fall, the last generation of the season will produce far more weevils than all of the preceding generations of the season put together. By the total destruction of the cotton plants three to five weeks before the first hard killing frost (which is, roughly speaking, the time when weevils seek hibernating quarters), the development of this last brood of weevils is entirely prevented. By this step the farmer can reduce by more than one-half, the number of weevils that would ordinarily be present to go into hibernating quarters early in December. Of equally as great importance is the fact that this destruction of the cotton plants forces all weevils which have reached the adult stage prior to the time of this destruction to remain without food until time for them to enter hibernation. In the average season, only a small per cent could possibly survive as long as five weeks without food. On October 16th, 1905, a supply of adult weevils was collected in a cotton field in DeSoto Parish, all of them being taken from squares upon which they were feeding. These weevils were furnished with water daily, but were not given any squares or bolls upon which to feed. By October 28th, 50 per cent of them were dead, and by November 6th, 84 per cent were dead. It is very doubtful if any of them will survive until December 1st, and, judging from the actions of the weevils in the fields at present, it does not seem likely that any considerable number will seek hibernating quarters before the latter date.

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*Bulletin No. 51, Bureau of Entomology, p. 97.

The early fall destruction of the cotton plants accomplishes a double purpose: the prevention of the development of the usual late autumn brood of weevils, and the death by starvation of at least 75 per cent of the weevils that are present in the fields at the time the plants are destroyed by the planter.

Practically the only objection to this fall destruction of the cotton plants which has been advanced, is that the stalks cannot be destroyed early in autumn without sacrificing a considerable part of the crop not yet gathered. Under the present system in vogue on most of the Louisiana farms, the objection is a valid one, BUT THE SYSTEM MUST BE CHANGED to that of planting an early variety of cotton, planting it early and giving it proper care and cultivation. If this is done, the bulk of the crop will be open and ready for picking before the time arrives for the destruction of the cotton plants. The mere fact that some farmers do not have the labor at hand to pick out the cotton within a reasonable time after it opens, is by no means the fault of the remedy. The early fall destruction of the cotton plants is an absolute requisite to successful and profitable cotton production with the weevil present, and the farmer in the weevil-infested section who cannot adapt his labor conditions and farming methods to meet this requirement will save money by not attempting to grow cotton.

In most of the Red River Valley, and in the eastern portion of the territory which has not been entered by the boll weevil until the present season, the weevil damage is not likely to be excessive in 1906, regardless of what farming methods may be followed. However, to prevent a severe loss from the weevil in 1907, it will be necessary for the farmers in this territory to destroy their cotton plants in the fall of 1906. In order to have their cotton picked and out of the way before the time arrives for this destruction of stalks next fall, they must adopt the cultural remedy and methods next spring.

The fact should not be overlooked, that in a boll weevil-infested section, no "top crop" is ever produced. The top crop must be sacrificed, either to the weevil, or to the "fall destruction" of cotton plants. So long as the latter is a direct and effective step in reducing the weevils' numbers, the sacrifice is turned to good account. It is also evident that the value of the so-called "top crop" has been greatly magnified in most sections, and its loss, in reality, does not greatly affect the total production.

Upon small farms, where sufficient stock is at hand, cattle can be turned into the cotton fields, and by close grazing they will entirely destroy the weevils' food supply, making the actual destruction by the planter unnecessary. This plan will not prove entirely satisfactory, however, unless sufficient cattle are at hand to keep destroyed all squares and leaves as fast as they are formed upon the plant. It is perhaps unnecessary to utter a word of caution against admitting cattle to fields where, for any reason, Paris green has recently been applied.

In fields where the cotton caterpillar entirely defoliates the cotton by the middle of October (in average seasons), actual destruction of the stalks is also unnecessary, as the total destruction of all foliage and squares disposes of the great bulk of the weevils' food supply and breeding places. The work of the caterpillars should not be depended upon except where the defoliation is complete. Where the caterpillar has entirely defoliated the major part of a field, leaving an occasional small area still green, this latter should be destroyed by the planter.

We do not expect the reader to accept the foregoing too liberally, and refrain from applying poison for the caterpillar when the latter appears early in the season. Regardless of the good that the caterpillar may do in the fight against the weevil late in the season, the caterpillar itself must be kept in control during early and mid-summer.

Upon bottom lands, where the growth of the cotton plant is luxuriant, a few caterpillars through the cotton fields in the

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CIRCULAR NO. 4

OF THE

State Crop Pest Commission

OF

LOUISIANA.

THE SAN JOSE SCALE.

Its Nature and Habits; How to Detect It and How to Control It.

BY

WILMON NEWELL.

ISSUED BY THE

STATE BOARD OF AGRICULTURE AND IMMIGRATION.

J. G. LEE, Commissioner.

BATON ROUGE:
THE TIMES, OFFICIAL JOURNAL OF LOUISIANA.
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State Crop Pest Commission

Of Louisiana.

CIRCULAR NO. 4. December, 1905.

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THE SAN JOSE SCALE, A DESTRUCTIVE INSECT ENEMY OF DECIDUOUS FRUIT TREES.

Its Nature and Habits, How to Detect It and How to Control It.

BY WILMON NEWELL.

The advent of the boll weevil in Louisiana has made it expedient for the general farmer to give consideration to the production of crops other than cotton. While the damage from the boll weevil has not thus far been seriously felt in more than two or three very limited areas in Louisiana, still it is destined within a few years to render impossible profitable cotton culture *upon as large a scale* as formerly, and at the present time it does not appear possible to permanently prevent this insect from crossing the entire State. While the proper administration of sensible and reasonable quarantine measures will in all probability prevent the weevil from being transported long distances in shipments of cotton seed and hulls, thereby causing isolated infestations to appear many miles ahead of the line of gradually advancing infestation, the migratory habits of the weevil will render futile any attempt to permanently confine the area of infestation to its present limits. In the light of present knowledge, ultimate boll weevil infestation of the entire cotton-producing area of Louisiana appears inevitable.

The farmer who shall have successfully adapted himself and his methods to a diversified system of agriculture by the time the boll weevil infests his plantation severely, will feel the ravages of this insect but little. In this diversification, the production of fruit should, and doubtless will, play a most important part. The climate and soils of Northern and Western Louisiana are eminently adapted to the production, not only of small fruits, but also of the more important commercial fruits, such as peaches, pears, etc. The red clay soils of the upland sections of Louisiana differ in no essential from the red clay soils of Tennessee and Georgia, which have long since become famous for their commercial peach orchards.

A commercial peach orchard, intelligently and properly cared for, has repeatedly proven to be far more profitable than the best crop of cotton that can be grown, even when the latter brings from twelve to fifteen cents per pound. As yet the fruit-growing possibilities of Louisiana have not been even fairly tested, but many of those who have already undertaken commercial peach growing in North Louisiana have demonstrated that the conditions there prevailing are as near the ideal as could be obtained anywhere.

Doubtless the most serious obstacle to successful fruit growing, by both the commercial grower and the farmer, is the insect pest known as the San Jose (pronounced San Ho-zay) scale, which has, unfortunately already obtained such a foothold in many parts of Louisiana as to make its complete eradication and extermination impossible. Many farmers have undertaken the production of an orchard and have started out under apparently favorable conditions, with trees that grew vigorously for the first year or so, only to find that when the trees reached bearing age they began to die rapidly and in the course of three or four years the orchard was ruined completely. It is safe to say that not one farmer or fruit grower out of fifty has, under such circumstances, recognized the minute insect responsible for the destruction of his orchard. During the past few months the writer has met dozens of intelligent, up-to-date farmers and fruit growers who have had this experience, and who were in entire ignorance of the reason for their failures. On making an examination of the few straggling trees that remained of the former "orchard," the writer has invariably found the San Jose scale in abundance. From observations made during the past season the writer is convinced that the San Jose scale, more than all other agencies combined, has been responsible for the failure of the peach crop to become of great importance, for if properly cared for, this should be one of the most important crops, from a financial standpoint, in North Louisiana.

The occurrence of this pest within the State may be ascribed principally to the fact that Louisiana has not until very recently had in effect a quarantine system against this and other fruit tree pests. All of the leading fruit-growing States of the Union, and, in fact, a majority of all the States, have for several years had in force quarantine laws which made it practically impossible for nurserymen with scale-infested trees, to market their stock in those States. The natural result has been that those States wherein quarantine laws did not exist, or were not enforced, have been the "dumping grounds" for nurseries whose stock was infested with the pest and therefore barred from the States that were properly protected.

The fruit-tree "peddlers," many of whom make a practice of purchasing poor or worthless nursery stock at a low price and peddling it out to farmers who are ignorant of its true condition, have also doubtless been responsible for much of the dissemination of this pest in Louisiana.

When the San Jose scale first appeared in the Eastern States, the fruit growers were inclined to give up all hope, and many fears were expressed that the advent of this little insect would prove the destruction of the entire deciduous fruit-growing industry of the country. However, after a number of years of pains-taking experiments, carried on by entomologists and Experiment Stations over the entire country, assisted by the larger commercial fruit growers, an effective remedy for this pest has been devised, and the progressive, intelligent fruit grower need have no fear of this pest destroying his orchards, or even reducing their productiveness or longevity if he will combat it intelligently.

As the State Crop Pest Commission was established to deal not only with the cotton boll weevil, but with other serious crop and fruit pests as well, and as the San Jose scale is already a serious obstacle to successful fruit growing, it seems but proper that the Commission should at this time publish a description of the San Jose scale, together with the remedies that should be

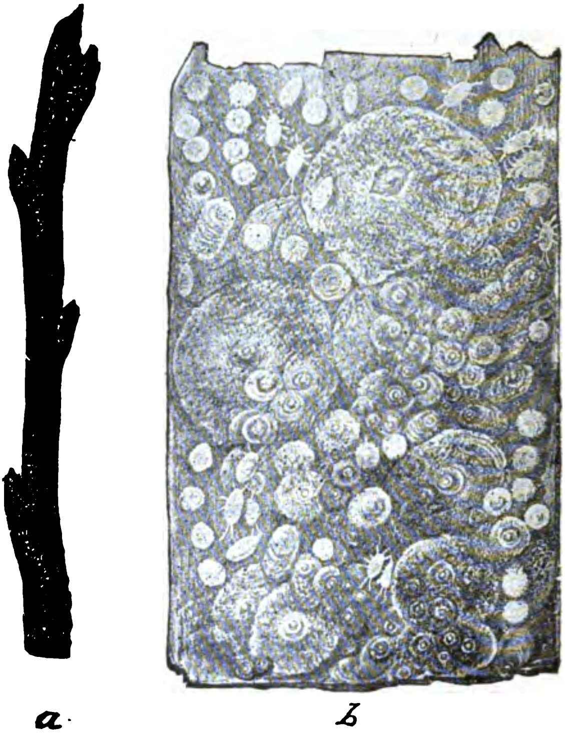

FIG. 1.—Appearance of San Jose scale upon the bark of a fruit tree: a, infested twig, natural size: b, bark as it appears under hand lens, showing scale in various stages of development, and young larvae. (After Howard & Marlatt, Bul. No. 3, n. ser., Div. of Entomology, U. S. Dept. of Agriculture).

applied in infested grounds and orchards. The descriptions and illustrations of the insect, it is hoped, will be of assistance to fruit growers in recognizing the pest in their orchards, while the remedies recommended we know from experience and observation to be fully efficient. The present short bulletin does not present any facts new to entomologists or Experiment Station workers, but is made up for the most part of compilations and from the experiments and observations made by the writer in other States.

History of the San Jose Scale.

The San Jose scale was first described in 1880, by Prof. J. H. Comstock, then Entomologist of the U. S. Dept. of Agriculture, from specimens taken in Santa Clara County, California. Prof. Comstock at that time gave it the very appropriate name of *Aspidiotus perniciosus,* meaning the pernicious scale, as it has since proved itself to be one of the most pernicious pests with which the fruit grower has ever had to deal.

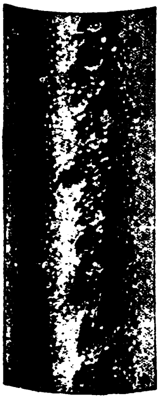

FIG. 2.—San Jose scale on peach twig, twice natural size (After Britton, Bul. 151, Conn. Exp. Station).

Owing to its abundance in the San Jose Valley of California the common name of "San Jose scale" came to be applied to it. Although not described until 1880, the insect had, as early as 1873, become a serious pest in the San Jose Valley.* How it obtained a foothold in California, and the country from which it had been imported, remained for many years in doubt. The finding, in later years, of San Jose scale upon trees imported from Japan, gave rise to the opinion that that country was its native home. Not until 1901-02 was the original home of the insect known with certainty. During those years Prof. C. L. Marlatt of the U. S. Dept. of Agriculture, made a special trip of investigation through Japan and China, with the result that he definitely located the native home of the San Jose scale in that portion of China lying to the north and west of Pekin.** While the San Jose scale continued to encroach upon new territory in California, it was apparently several years before it entered the country east of the Rocky Mountains. The first discovery of the pest in the East was at Charlottesville, Va., in 1893, and subsequent investigations showed beyond a reasonable doubt that it had reached Charlottesville from a nursery in New Jersey. The discovery of infestations in various parts of the country, all of them traceable directly or indirectly to one or the other of two New Jersey nurseries, started an investigation which revealed the fact that the

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*Bul. No. 3, n. ser., Division of Entomology, p. 12.
**Yearbook, U. S. Dept. of Agriculture, 1902, p. 166.

scale had been sent to New Jersey in 1886 or 1887 with a shipment of Kelsey plums from the San Jose locality in California.* From their infestation in 1886 or 1887, until the agitation of 1893 and '94, the two New Jersey nurseries mentioned had been steadily shipping nursery stock to various parts of the United States, and with many of the shipments the scale went also. The result was that many nurseries, in a number of different States, became infested, and from these as new centers of infestation, the spread of the insect to orchards was rapid. At the present time nearly every fruit-growing section of any importance is more or less infested by this pest, and a careful study of almost any outbreak makes it possible to trace the insect back, indirectly, to the 1886 (or 1887?) shipment from California to New Jersey.

In Louisiana, the pest is known to occur in over a dozen localities, some of them widely separated, and when a careful survey and inspection of the various orchard sections of the State has been made, no doubt many more localites will be added to the list.

What the San Jose Scale Is.

The San Jose scale is a very small insect belonging to the order known as Hemiptera, or true bugs. While not by any means microscopic in size, the individual insects are sufficiently small to escape the notice of persons not accustomed to looking for scale-insects.

The females, during their entire existence (with the exception of a few hours following birth), and the males from the larval stage to maturity, are protected beneath a scale-like covering consisting in part of secretions from the body of the insect, and in part of shed or molted skins cast off by the insect at different periods in its development. The San Jose scale is a sucking insect and feeds by inserting its long thread-like beak through the bark into the sapwood of the plant upon which it is located.

The adult female scale is, roughly speaking, about the size of a pin-head and is of a dark grayish color. The scale is nearly round and has near its center a pronounced "nipple" or eleva-

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*Bul. No. 3, n. series, Div. of Entomology, p. 15.

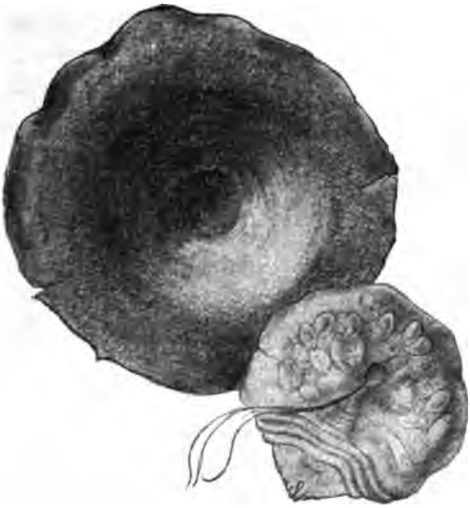


FIG. 3.—Adult female scale turned over, exposing legless and wingless insect.

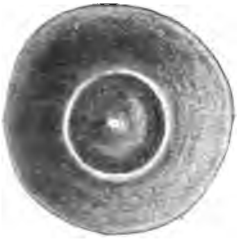


FIG. 4.—Half-grown female scale.

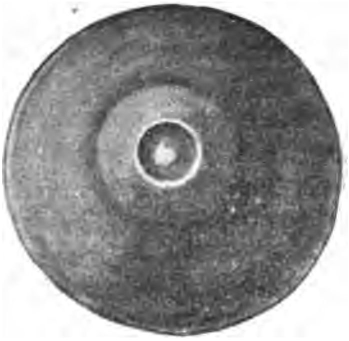
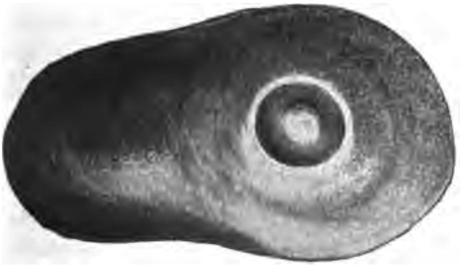


FIG. 5.—Full-grown female scale.



Full-grown male scale.

All much enlarged. (After Alwood, Va., Crop Pest Commission Bulletin No. 45.)

tion, which is surrounded by a fine groove or depression. This nipple-like prominence in the center, together with the ring surrounding it, is quite characteristic of this species and enables one familiar with the pest to recognize it readily in the majority of cases.

If the scale be gently lifted with a knife-point or a pin, a yellowish soft-bodied insect, devoid of both legs and wings, will be found beneath it. This is the insect itself, the creature which really does the damage. The male scale, while rather closely resembling that of the female, is somewhat smaller and is more elongated.

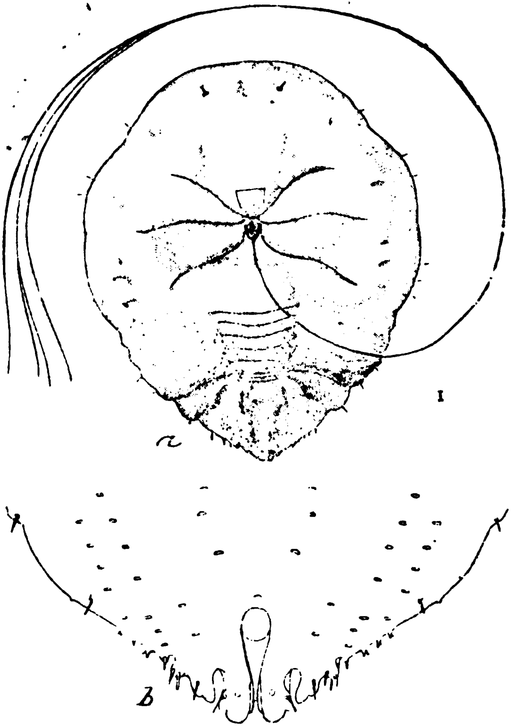


FIG. 7.- Adult female, before development of eggs: a, ventral view, showing long sucking mouth parts; b. posterior margin of anal segment as seen under microscope—greatly enlarged. (After Howard and Marlatt, Bul. No. 3, n. ser., Div. of Entomology, U. S. Dept. of Agriculture.)

When the scales occur abundantly upon a twig or limb, the latter has the appearance of having been dusted over with ashes.

A grayish, scurfy appearance of a peach, plum or apple tree should at once excite suspicion. In the case of badly infested trees the scales frequently occur in such great numbers upon the medium-sized limbs that the bark itself is invisible. When an infestation reaches this stage the tree is commonly referred to as "incrusted." During summer the immature stages of the insect are found along with the adult scales, and at this time also the larvae, minute yellow lice, may be found crawling about in abundance over the twigs and limbs. The half-grown female scales are usually almost jet-black in color and are quite different from the partially-matured scales of closely related species.

If the finger-nail, or a knife-blade, be rubbed over a badly infested limb upon which the insects are alive, their bodies will be crushed and the body fluids exuding will not only be visible to the naked eye but will give a smooth, greasy appearance and feeling to the portion rubbed.

Another feature, while by no means characteristic of this scale, which is of considerable assistance in identification, is the reddish cast given to the cambium (sapwood) of the affected twigs and limbs. Where isolated insects occur, the scale, especially upon peach and plum, is surrounded by a reddish area, and if the bark be trimmed from a thoroughly-infested limb the wood just below the bark will be found mottled with red blotches and spots.

While the San Jose scale rarely gets upon the fruit of peach trees, the downy covering of the peach being objectionable to the young lice, the insects do often occur in abundance upon the fruit of plum, apple and pear trees. On fruit the red discoloration is very evident, and we have seen many apples and pears that were so thickly infested that they had become deformed and knotty. In infested peach orchards, the young lice crawl onto the peach leaves in great numbers and establish themselves there, either on the upper or lower surface, usually right next to the mid-rib of the leaf. Red spots quickly follow the attack of the scale upon the peach leaf, and a sprinkling of red spots over the leaves often indicates the presence of the pest even when the infestation upon the limbs and trunk is not sufficient to attract casual attention. In our Southern climate, peach trees attacked by this insect rarely survive to exceed three or four years and their productive capacity, if they are allowed to remain untreated, is often seriously impaired by the second season of infestation.

The San Jose scale is known to occur upon a great variety of trees and plants. Mrs. H. T. Fernald, in her "Catalogue of Coccidae"* gives a list of sixty-five different plants upon which this insect has been found. Upon the majority its occurrence is only occasional, and it cannot be considered a serious pest to more than a few of them. In the South, severe infestations may be looked for upon all varieties of apples, plums, and peaches as well as upon cottonwood, Carolina poplar, Bois D'Arc and the hardy orange (*Citrus trifoliata*). While it is frequently a most serious pest of pear trees in the North, it apparently does not thrive as well upon the pear in the South, although pear trees are occasionally found that have their growth and productive capacity severely impaired by the attacks of the scale. Carolina poplar trees often become very heavily infested, but owing to the vigorous growth of this tree it usually outgrows, in a sense, the attacks of the scale.

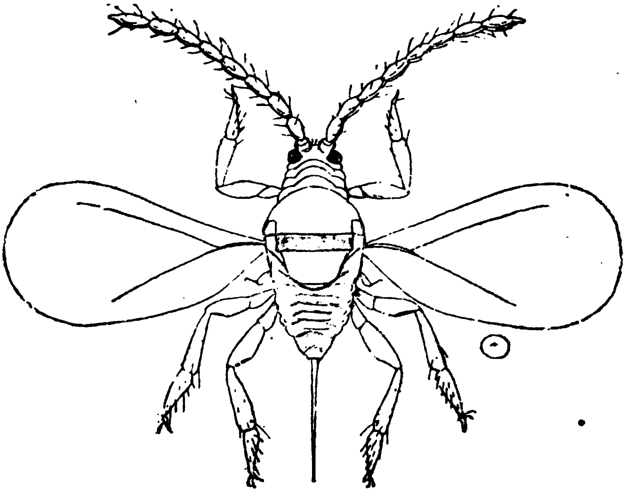


FIG. 8.—Adult male San Jose scale—much enlarged. (After Howard and Marlatt, Bul. No. 3, n. ser., Div. of Entomology, U. S. Dept. of Agriculture.)

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*Bulletin 88, Hatch Exp. Station.

While the San Jose scale cannot be considered as a serious pest of pecan, walnut and other fruit and forest trees, still it must be remembered that such plants when carrying the scale, may serve as sources of infestation for peach or other orchards. Even though the pest may breed for several genrations upon a nut or forest tree, barely maintaining its existence, when spread or transferred from this unfavorable host plant to a favorable one, such as a peach or plum tree, it again breeds as rapidly as ever and becomes fully as destructive as if it had not been forced to subsist for one or more generations under adverse conditions.

Scale Insects Often Mistaken for the San Jose.

The finding of scale insects in an orchard is not of itself proof that the orchard is infested with San Jose scale, for there are a number of other insects native to Louisiana, that closely resemble it. Among these may be mentioned the Cherry scale, Putnam's scale, Gloomy scale and the Obscure scale. Unlike the San Jose scale these native species are preyed upon to a very considerable extent by ladybugs and other predacious insects which tend to hold them in check. Their rate of increase is not nearly so great as that of the San Jose and hence they are not nearly so injurious.

The Cherry scale* can be found in almost any peach orchard but usually in only limited numbers. While of nearly the same size as the San Jose scale, it is more flattened and has the exuviae (composing the central elevation on the scale itself) of an orange red color. As a usual thing the individual scales of this species are widely scattered over a tree and are parasitized to a marked extent. In only one case have we seen this species abundant enough to cause appreciable injury. Owing to the general occurrence of the Cherry scale, cases are often found where both this scale and San Jose occur together upon the same tree. While the two species have characters by which they are readily separated when a microscopical examination is made, they are frequently difficult to distinguish in the field, and in many cases cannot be distinguished except by one thoroughly familiar with scale-insects.

**Aspidiotus forbesi.*

Putnam's scale(*a*) is frequently found in Louisiana and while it seems to prefer shade or ornamental trees (such as maple, cottonwood, etc.) it is occasionally found on orchard trees. It is not usually as heavily parasitized as the cherry-scale and is therefore a more dangerous pest. In destructiveness it does not approach the San Jose scale.

The Gloomy scale (*b*) is very cosmopolitan in habit and affects a great variety of trees, being however, but rarely found in orchards. On streets and private grounds in Shreveport we have found it in abundance, indicating that the conditions in Northwestern Louisiana are decidedly favorable for its rapid increase.

The Obscure scale(*c*) is for the most part found upon water oak(*d*) and is a comparatively large, dark-colored, flattened scale, very unlike the San Jose, but is nevertheless often mistaken for that species.

When scale insects are found, especially upon fruit or ornamental trees, they should be sent to the Crop Pest Commission for identification. The writer will take pleasure at all times in advising fruit growers and farmers regarding the identity of scale-insects found in their orchards and gardens.

It is not within the province of this paper to discuss even briefly the scale-insects of the State, nor even the injurious species, of which there are many. A number of these species will be treated of at a later date in a paper contemplated by the writer and one of his assistants.

The remedies recommended herein for the San Jose scale are fully efficient against the other species mentioned above when they occur upon deciduous trees. The sprays mentioned on subsequent pages cannot, however, be used upon citrus trees or upon evergreens.

Development and Life History.

Unlike the majority of our native scale-insects, the female San Jose scale does not deposit eggs, but is viviparous. In other words, the young are born active, the eggs hatching within the

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(*a*) *Aspidiotus ancylus.*
(*b*) *Aspidiotus tenebricosus.*
(*c*) *Aspidiotus obscurus.*
(*d*) *Querous aquatica.*

body of the mother instead of developing after the deposition of the eggs as is the case with most insects. The young when born are minute yellow creatures scarcely visible to the naked eye, and are possessed of six legs, two antennae or feelers, and a well-developed beak. They are active as soon as born and for the first few hours of their existence devote themselves to a diligent search for a location that is to their liking.

At any time during the summer these minute crawling "lice" may be seen running about on the leaves, fruit and bark of badly infested trees. Within a few hours—usually from 12 to 36—after birth, the young louse finds a place where the bark is not too thick, inserts its beak through the bark into the sapwood beneath and commences feeding. Within a short time, waxy filaments, secretions from the dorsal portion of the body, make their appearance and soon form a grayish-white mat over the insect. This is the beginning of the scale covering, and as the insect develops, the covering is added to from time to time by more secretions, and by the skins which are shed by the insect as it grows. If the individual be a female it remains in this position during its entire life, and shortly after locating and commencing the formation of a scale, loses feet, eyes and antennae, becoming entirely incapable of moving about. The skins which are thrown off from time to time as the insect grows are added to the scale-covering until at last the female reaches maturity, by which time the scale has become dark-colored, its particular shade being determined to a very large extent by the color of the bark upon which it happens to be located.

The development of the male is similar, the legs being lost soon after the beginning of scale formation. Instead, however, of all the molted skins being added to the scale-covering the male adds but one, the first, and the skins molted subsequently are pushed out from under the scale.* When the male reaches maturity it becomes a small, delicate, two-winged insect and in this form issues from beneath the scale that has protected it.

The development of a generation, from time of birth to maturity, varies from four to six weeks, according to the prevailing temperature and the time of year. Within a few days after reaching maturity, and after having been fertilized, the female commences giving birth to living young and continues bringing forth living young for a period (in summer) of about six weeks. Observations made by the writer in Southern Georgia indicate that in the southernmost parts of the United States, young may be produced at almost any time during the winter, during a continued warm spell, the females suspending operations whenever a cold snap makes its appearance. At Moultrie, Ga., Prof. W. M. Scott found active larvae during twelve months in the year, and as there is considerable territory in Louisiana that is south of the latitude of Moultrie it would not be at all surprising to learn that the insect breeds during the entire year in the lower Mississippi Valley, or in those sections south of New Orleans.

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*Howard & Marlatt, Bul. No. 3, n. ser., Div. of Entomology.

During the productive period of six weeks or over, the female insect gives birth to from 150 to 500 young and as these commence their development soon after birth, it is readily seen that in a short time individuals of all ages are found upon infested trees. As a result it is impossible by mid-summer to distinguish one generation from another. Dr. Howard found that in the latitude of Washington, D. C., there were at least four generations per year and perhaps a partial fifth generation. As far south as Louisiana there seems little doubt but that there are at least six full generations during the year and possibly more.

When one considers the rapidity with which these insects reach maturity and the enormous number of young produced by a single female, some idea of their capacity for destruction is obtained. Dr. Howard has estimated, conservatively, that the progeny of a single pair may, in the course of a single season, amount to the enormous number of 3,216,080,400.*

Means of Dissemination.

Dissemination may well be considered under two heads, dissemination locally from tree to tree and from orchard to orchard, and dissemination over long distances, as from one locality to another.

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*Bulletin No. 3, n. ser., Div. of Entomology.

The spread from orchard to orchard, or from one tree to another in any given orchard, is entirely through the agency of the young crawling lice. As the males, although winged, cannot of themselves disseminate the species and as the females remain in one spot during their entire lifetime, it will be seen that neither the adult females nor males can directly cause new infestations, or even infestation of adjoining trees. However, the young lice crawl about readily during the first few hours of their existence and where the branches of trees interlock they crawl readily from one tree to another. Birds, alighting upon badly infested trees, get the small lice upon their feet and when they afterwards alight upon other trees the lice crawl off to locate upon the twigs and limbs and commence their development. The transportation of the lice by birds is of such common occurrence that many inspectors, when entering an orchard for the purpose of looking for San Jose scale, go directly to birds' nests, if any are in view, and examine the twigs immediately surrounding them. In nearly all infested orchards, and even in many cases where the infestation is still very light, the scales are found in greater abundance around birds' nests than elsewhere in the immediate vicinity. This also accounts for the fact that a belt of heavy timber between orchards is a very effectual barrier to the natural spread of the scale from one orchard to the other. Birds coming from an infested orchard are not likely to pass through a belt of timber to another orchard without alighting upon the forest trees and loitering about more or less, during which time the lice upon their feet and legs have an opportunity to get off. It is quite likely that the many large insects which frequent orchards are instrumental in carrying the young San Jose scale lice from tree to tree, and in fact the writer once found two of these young lice upon a large flower beetle (*Allorhina*) taken in an orchard where the scale occurred.

Horses and mules used in cultivating orchards and nurseries jar the limbs with which they come in contact and thus get the young lice upon them. The lice are again rubbed or shaken off on to other trees some distance away, as is evidenced by the fact that in peach orchards where the cultivation is in only one direction the spread of the scale is invariably greatest in the direction of cultivation and not at an angle to it.

Quite conclusive evidence that the San Jose scale is thus disseminated upon teams and tools was found during the past season in a block of nursery stock about 200 yards in length and about 50 yards in width, the rows running lengthwise of the block. This entire block had been budded in the spring of 1904 with buds shipped from a distance. Upon examination of this block of nursery stock in October, 1905, an occasional tree was found which was practically incrusted with the San Jose scale, the infestation being much the heaviest upon the lower part of the trunk near the point where the bud had been inserted. Evidently these trees became infested as the result of an occasional bud of the original lot bearing one or more scales. That the number of scales on the buds was very small was evidenced by the small number of trees infested in this manner. In several other portions of the same block many trees were found infested with but a few scales, and these scales were in all cases upon the side limbs and upon the tops, never upon the lower part of the trunks. The distribution of the scale through this block in such a manner (See Figure 9) cannot be explained except by the supposition that the minute lice were carried from the heavily-infested trees to the others upon the horses or harness used in cultivating the trees.

Mr. R. I. Smith, State Entomologist of Georgia, cites a case in which peach pickers evidently carried the scale from one orchard to another. In the forenoon of a certain day the "gang" of pickers worked in an infested orchard and in the afternoon of the same day worked, with the same baskets, in an uninfested orchard some distance away. A few months later infestation by the scale was found in the latter orchard and was most in evidence near the point where the pickers had first entered when coming from the infested one.

It seems likely that winds may blow the young lice from one tree to another and it seems to the writer not at all improbable that whirlwinds, such as are often prevalent during the dry summer months, may take up hundreds of these lice from an infested tree, only to let them descend broadcast over a considerable area when the force of the whirlwind is expended. This, while a theory only, would account for many peculiar cases of local distribution which seem inexplicable in any other way.

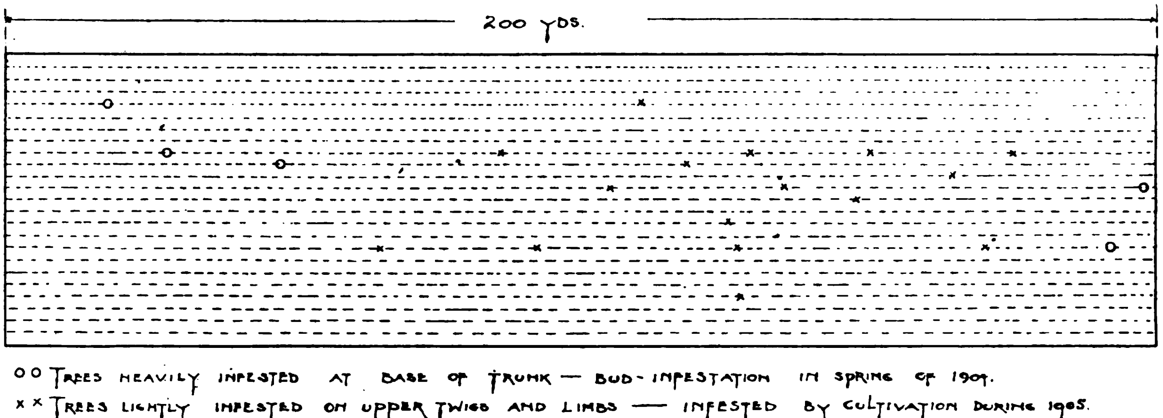
200 YDS.
OO TREES HEAVILY INFESTED AT BASE OF TRUNK — BUD-INFESTATION IN SPRING OF 1904.
×× TREES LIGHTLY INFESTED ON UPPER TWIGS AND LIMBS — INFESTED BY CULTIVATION DURING 1905.

FIG. 9.—Diagram illustrating how San Jose scale is distributed by teams and tools used in cultivating orchards and nurseries. The diagram illustrates the actual conditions found in a block of nursery stock in October, 1905. The trees were budded in the spring of 1904, a few of the buds being infested, resulting in heavily infested trees at the points marked by circles. During 1905 the scale was distributed along the rows of trees (indicated by dotted lines) and resulted in twig-infestation of trees at the points indicated by the cross-marks.

Many people have thought, and with good reason, that the scale might be distributed upon scale-infested fruit, such as apples or pears. While an infestation might result from the indiscriminate throwing of infested fruit or parings into or among susceptible plants, still we believe that very few infestations actually obtain a start in this manner. A few years ago, the writer conducted experiments under the direction of Prof. F. M. Webster, in Ohio, in which infested fruit and parings from infested pears and apples were placed in contact with the trunks of young apple trees, but no infestation of the latter could be detected up to a year afterwards, at which time the observations had to be abandoned.

Where infested trees are pruned late in the spring or early in the summer it is possible for the pruned twigs or limbs to carry living scales, as well as young lice, for some little time, and if thrown among uninfested trees or plants an infestation of the latter might easily result.

Infestation of nurseries frequently results from the taking of budding or grafting wood from trees in infested orchards. Many nurserymen prefer to secure their buds from bearing trees whenever possible in order to be certain that their trees are true to name. Slight orchard infestations by the scale are very easily overlooked and hence it often happens that twigs are cut for grafting or budding purposes which have upon them a few scales. Occasionally individual scales are concealed beneath a bud and are invisible until the bud is actually removed. A single fertilized female is, of course, able to start an infestation that in the end will prove as serious as if the infestation had been by hundreds of thousands of scales. Doubtless more nurseries have become infested in this manner than in any other, barring possibly the purchase of stock from infested nurseries, for when even a few lightly infested trees are "lined out" with healthy nursery stock the infestation spreads over a considerable area of the nursery during the first season.

Nurserymen can guard to good advantage against infestation by budding or grafting wood by having the orchards from which the wood is to be taken inspected annually by a skilled inspector. This is practiced by the majority of progressive nurserymen in

Georgia, and in dozens of instances infestation of nurseries has been prevented by the inspector finding San Jose scale in the orchards from which the nurserymen intended to obtain buds or grafts, and advising the nurserymen regarding the danger of obtaining buds from these sources. The fumigation of all budding and grafting wood (in the case of deciduous trees only) with hydrocyanic acid gas before use is likewise a good precaution for every nurseryman to take.

Dissemination of the San Jose scale over long distances, and from one portion of the country to another, is almost entirely by the shipment of infested nursery stock. Nurserymen cannot conveniently grow all of the fruits and plants which their customers are likely to call for, and it is often also impossible for the nurseryman to foresee the extent of a season's demand for fruits of certain varieties. Hence it comes about that almost every nurseryman has occasion to purchase stock from other nurseries, and in order to secure varieties demanded by his trade it is often necessary for him to make these purchases from nursery firms many hundreds of miles distant. Naturally he is often ignorant of the conditions surrounding these latter nurseries and of the extent to which their stock has been exposed to possible infestation. Hence the scale is not infrequently shipped from one nursery to another, with the result that the nurseryman receiving the infested stock gets the majority of his own trees infested in turn and distributes them—often without a knowledge of their true condition and without malicious intent—to his customers. As stated upon a previous page, the progress of the San Jose scale from California to New Jersey and thence to nearly every State east of the Rocky Mountains has been clearly proven to have been by shipments of nursery stock.

The only logical and practical way to prevent the spread and dissemination of San Jose scale through shipments of nursery stock is by the enforcement of a practical quarantine law whereby every nurseryman is required to have his stock inspected annually by a competent inspector, under State supervision. Such a quarantine law should successfully prevent the sale or shipment of stock from infested nurseries under any and all circumstances. The State Crop Pest Commission has enacted quarantine regulations (having the force of law) which it is believed will meet these requirements. Particular mention of these regulations is made upon a subsequent page.

In addition to the inspection of nursery stock, the proper fumigation of this stock affords an additional safeguard against the scale. Individual San Jose scales are very minute objects for which to search among hundreds or thousands of growing trees, and while a competent inspector, after a careful examination, may be able to say that in all probability this pest is not present in a given lot of nursery stock, still from the very nature of the case he cannot *guarantee* that the stock is absolutely free from this insect.. Likewise, while a thorough fumigation with hydrocyanic acid gas will in the great majority of cases kill all scales upon infested trees, the fumigation process, for a number of reasons, is by no means infallible. Hence it is clearly seen that trees which have not only been inspected, but which have also been properly fumigated, are the safest trees for the orchardist and farmer to buy. Infested trees should never be sold under any circumstances, regardless of how many times or how carefully they have been fumigated, and the fruit-grower who is watchful of his own interests will firmly refuse to purchase stock of nurserymen who are not provided with an inspection certificate, and will by preference make his purchases from nurserymen who also make a practice of carefully fumigating all trees which they ship or sell.

Nurserymen can profitably guard against infestation of their nurseries by not only purchasing fumigated stock, but they can wisely fumigate all stock which they receive, regardless of whether it has been previously fumigated by other parties or not.

Control of the San Jose Scale by Spraying.

Having in the previous paragraphs, touched upon the means by which the San Jose scale is distributed and the means by which both nurserymen and orchardists can be protected from infestation of their premises by the proper enforcement of quarantine and inspection regulations, and how orchardists can further guard against this pest by purchasing only trees which have been fumigated, we come now to consider the case of the man who is so unfortunate as to already have this destructive insect in his orchard or ornamental grounds.

Serious as the San Jose scale is, it can nevertheless be kept fully under control when occurring upon deciduous trees. This fact, however, cannot be taken as justification for introducing it into one's orchard or even for neglecting in the slightest degree those quarantine restrictions which prevent or limit its distribution. The treatment of infested orchards, while not particularly expensive, is nevertheless an expense which the fruit-grower does not have to incur so long as his orchard is free from the pest. The medical fraternity has quite recently demonstrated its ability to not only control, but to exterminate entirely, yellow fever, but no community of intelligent citizens would purposely permit the introduction of this disease simply because it can be controlled by the physicians. The same logic applies with equal force to the introduction of serious diseases and insect pests of fruit and other crops.

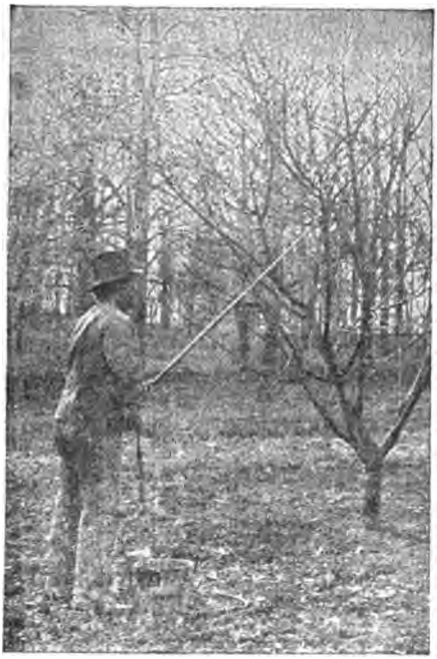

FIG. 10.—Spraying trees with the "bucket pump." (After photo by Britton, Conn. Exp. Station.)

Ever since the appearance of the San Jose scale east of the Rocky Mountains the Experiment Stations and entomologists of nearly every State have continuously and carefully conducted experiments with various remedies for this pest. Fumigation of infested trees under large tents or boxes was early attempted, but this process, though remarkably successful in its effects upon the scale, was not found practical, owing to its comparatively enormous expense and the necessity of having a somewhat complicated and expensive equipment for the work.

It is not necessary for us to review the various compounds and sprays, including oils of various kinds, caustic soda, emulsions of carbolic acid, "patent" preparations, etc., that have been at one time and another tested and advocated as remedies for this scale.

THE LIME-SULPHUR WASH.

After tests of many different preparations the one known as the "lime-sulphur-salt" wash, or "lime-sulphur" wash, has been found universally more effective than any other preparation. As this is a preparation that can be made by any fruit-grower or farmer with very little expense for apparatus, and as he has no profits to pay to anyone, except such profits as are made upon the raw materials (sulphur and lime), it is a remedy all the more desirable. As to the exact proportions of lime, sulphur and water necessary to insure the best results, both entomologists and fruit-growers differ considerably. The proportions given below are those which gave the best results, at a minimum of cost, in a long series of experiments made by the Georgia State Board of Entomology, in which the writer participated. Although we have not thus far experimented with this remedy in Louisiana, the conditions, so far as the culture of deciduous fruit trees is concerned, do not appear to differ materially from those obtaining in Georgia, and there is no conceivable reason why these preparations will not be fully as effective in Louisiana as in Georgia or any other State.

In preparing the lime-sulphur wash the best quality of stone lime should be used; lime which contains pebbles or flinty matter is undesirable. Ordinary ground sulphur, or "flour of sulphur"

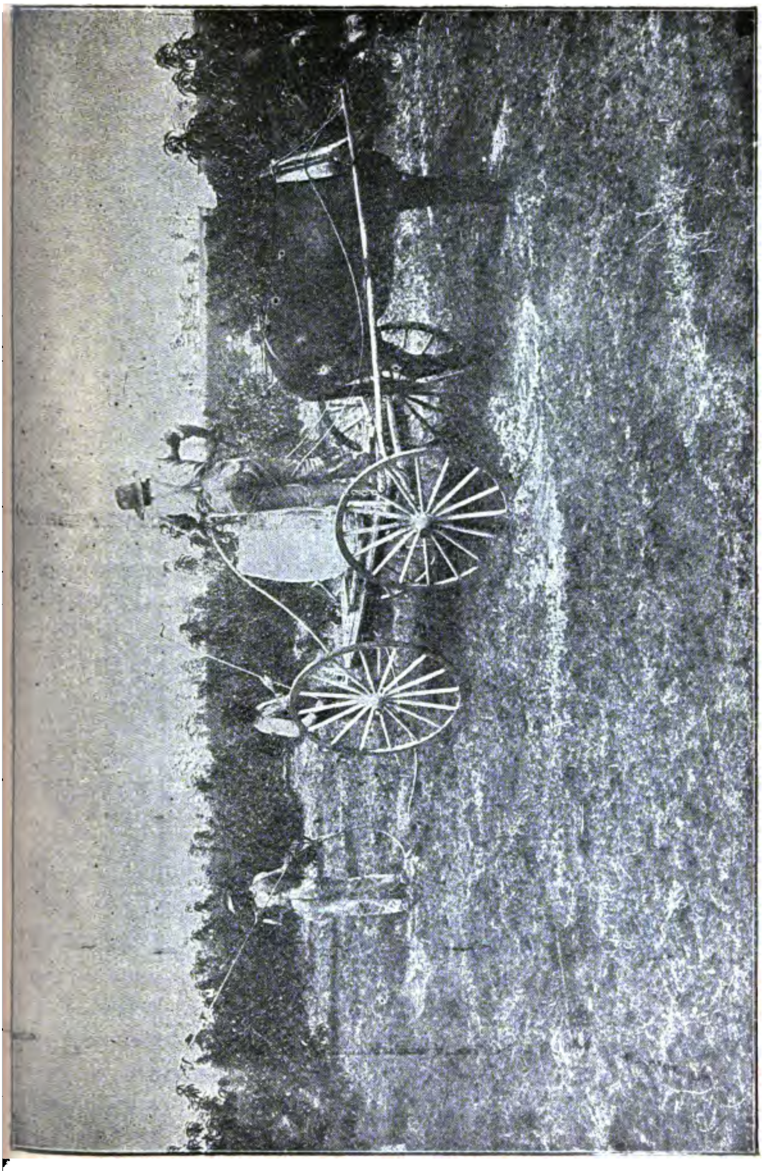

FIG. 11.—A suitable spraying outfit for a medium-sized orchard. Eclipse pump mounted in barrel, two leads of 20-foot hose, 6-ft. iron extension rods and single Vermorel nozzles (After Newell & Smith, Bul. 14, Ga. State Board of Entomology).

should be used. While theoretically "roll sulphur" ought to answer the requirements, its use is not practicable, owing to the fact that it is much more difficult to get into solution with the lime than is the ground sulphur. Fruit-growers should guard against the exorbitant prices sometimes charged for sulphur by druggists and dealers. A price of five cents per pound, for small quantities, usually allows the druggist a profit of 100 per cent. or better, which is amply sufficient. When ground sulphur is purchased by the barrel a price of three cents or three and one-half cents per pound at the initial shipping point is as high a price as the fruit-grower should consent to pay.

The proportions of lime, sulphur and water, which have given the best results and which combine with effectiveness the utilization of the smallest possible amount of material, are as follows:

Stone lime	21 pounds
Sulphur	18 pounds
Water	50 gallons

To prepare the lime-sulphur mixture place a few gallons of water in an iron kettle (preferably one holding 50 gallons or more) suitably mounted upon a base or brick arch over a fire, and bring this water to a boil. While the water is heating weigh out the stone lime required and place it to one side. Also weigh out the sulphur and mix it with just enough cold water to make a thick paste. Sulphur will not dissolve in water, but by stirring vigorously the sulphur and water can be made into a heavy paste which contains no dry sulphur.

When the water in the kettle has come to a full boil, dump in the sulphur paste, stir quickly with a long paddle to mix it well with the hot water and then immediately add the stone lime.

A very violent boiling will result from the rapid slaking of the lime in the hot water. This is exactly what is desired, for with the combined heat of the boiling water and that produced by the rapid slaking of the lime a higher temperature is obtained than can be secured by mere boiling alone. This sudden heating and violent agitation causes a considerable part of the sulphur to unite with the lime. When the violent reaction in-

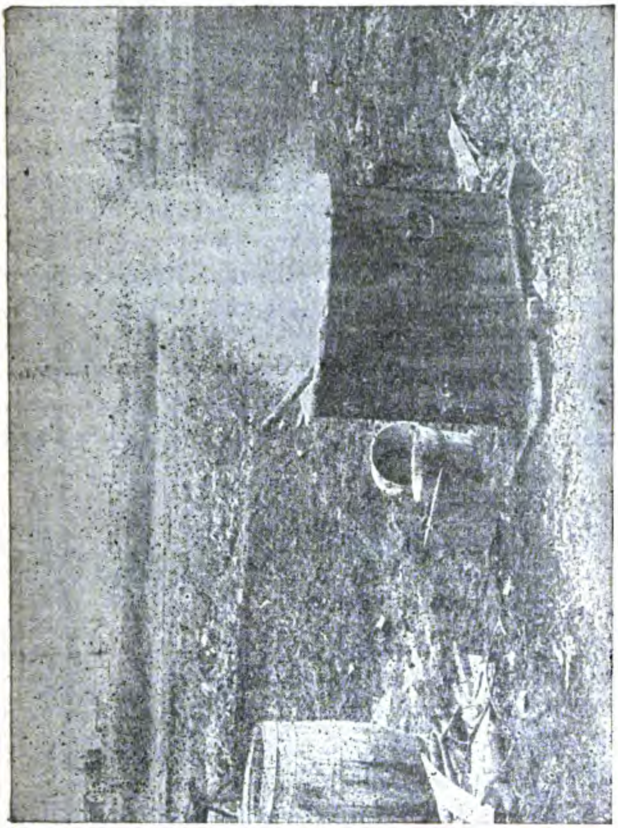

FIG. 12.—"Kettle outfit," in use boiling the lime-sulphur preparation (After Britton, Conn. Exp. Station.)

duced by the slaking of the lime has subsided, boiling should be continued for at least thirty-five minutes, water being added from time to time to keep the mixture thin enough to stir and to make up for evaporation.

After boiling for 35 minutes or more, water should be added to make the full 50 gallons of mixture. Either hot or cold water can be used for diluting. If desired, the mixture can be taken from the kettle and placed in a barrel and the water then added. The mixture should be taken immediately to the orchard and sprayed upon the trees while still warm. If the entire lot is not sprayed out at once, as would be the case when a bucket pump is used, the mixture should be left in the kettle and kept at or near the boiling point until used or until the day's spraying has been finished. There is no possible danger of the mixture being sprayed upon the trees *too* hot as the fine mist from the nozzle will be lowered in temperature before it comes in contact with the tree, even though the liquid in the spray tank be boiling hot. The warm mixture passes through the pipes and nozzles much more readily than does the cold and with less liability of clogging the nozzles. In fact, when this mixture is allowed to cool a large number of crystals are formed.*

These crystals can be re-dissolved by again heating the mixture, but as a usual thing time and labor are saved by making no more of the lime-sulphur mixture than will be used during the day's work of spraying.

Where one or more barrel pumps are used and the liquid sprayed out quite rapidly, two kettles are required to prepare the mixture as fast as needed. One man with two 50-gallon kettles can usually prepare the mixture fast enough to keep two barrel pumps constantly supplied.

When several thousand trees are to be sprayed and where economy of time and labor is an important factor the use of a steam boiling plant is desirable, the cooking of the mixture being done in barrels or small tanks with steam, instead of in iron ket-

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*Opinions of different writers are quite at variance as to the composition of these crystals. Prof. C. O. Houghton in a recent paper (Bulletin 64, Del. Exp. Station) gives their composition as hydrosulphide of lime, with the chemical formula $CA(SH)_2$.

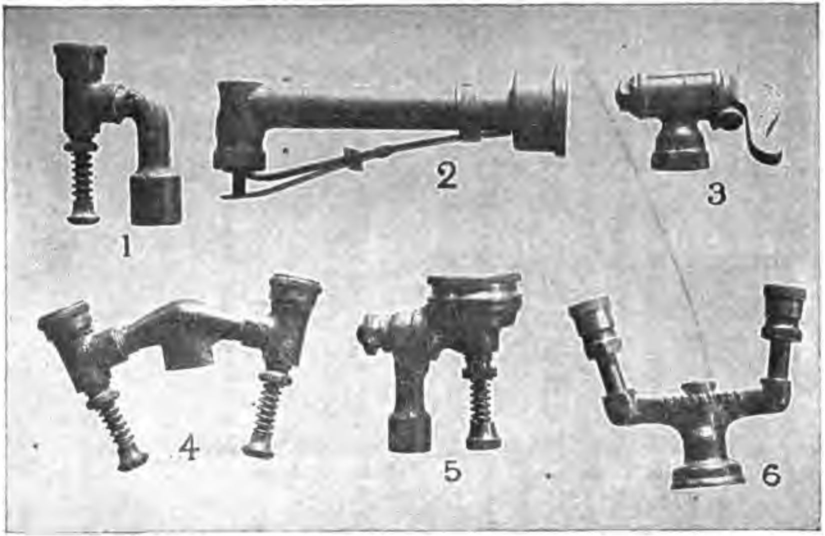

FIG. 13.—Common types of spray nozzles: 1, Vermorel: 2, McGowen: 3, Bordeaux; 4, Double Vermorel; 5, Mistry; 6, Double Spray-motor, (After Britton, Conn. Exp. Station Bulletin.)

tles over a fire. The boiler at a ginhouse or sawmill, if conveniently located, can be used as the source of the steam. Portable boilers such as are used in sawing wood, or even steam feed cookers, can be utilized. Where large orchards are to be sprayed, the purchase of a boiler especially for the purpose is justified. In arranging such a plant its size will, of course, be dependent largely upon the amount of the mixture required daily. Barrels should be provided in which to boil the mixture, and these barrels should be so placed upon a raised platform that the liquid when made can be drawn off directly into the spray tank or barrel without the labor of handling it with buckets. Steam from the boiler should be conveyed through an iron pipe to or near the bottom of each barrel, the steam supply to each barrel being controlled by a globe valve conveniently located. If water pressure is available a water pipe or hose should be run to each barrel to facilitate filling. If a well or stream is near the boiling plant a water supply is readily obtained by use of a steam jet.

The preparation of the mixture when steam is used differs in no essential respect from the preparation in a kettle. A small part of the water is brought to a boil in the barrel, the sulphur paste added and this followed by the lime. With a good pressure of steam it is not necessary to boil as long as where a kettle is used. Boiling should always be continued until a greenish-yellow tinge is imparted to the mixture. The particular color required is soon recognized after a little experience. In case of doubt, the boiling should be continued for at least 35 minutes or more, as it cannot be boiled too much. In recommending this 35 minute period of boiling, a *violent* boiling is meant. Mere simmering does not bring about the chemical union of the lime and sulphur which is essential to the success of the wash.

The exact arrangement of the boiler, steam and water pipes, barrels, etc., will vary according to the conditions under which the plant is arranged. Figure 15, showing a small steam boiling plant, will convey an idea of how such a plant may be constructed to good advantage.

THE LIME-SULPHUR-SODA WASH.

Upon private grounds and upon small premises in town or city, many people do not like to go to the trouble of making the boiled lime-sulphur mixture. For such conditions the lime-sulphur-soda mixture, a modification of the foregoing, which does not require boiling with steam or over a fire, can be made with less trouble, and while not nearly so effective as the boiled preparation is, nevertheless, a very effective agency against the scale. This wash is prepared as follows:

Lime	16 pounds
Sulphur	8 pounds
Commercial Caustic Soda	8 pounds
Water	50 gallons

Mix the sulphur into a thick paste *with boiling hot* water. Then add the caustic soda slowly (do not dissolve the soda in water) keeping the mixture thoroughly stirred. A brick-red color will appear almost at once. Continue the addition of the caustic soda and continue stirring, adding small amounts of *hot* water when necessary to prevent the mixture from becoming too thick. The soda should dissolve all of the sulphur in a few minutes, producing a clear, deep red liquid. Unless the liquid is entirely clear, with no particles of undissolved sulphur remaining, the mixture must be heated until all sulphur is dissolved. *It is absolutely imperative that all sulphur be dissolved and a clear liquid obtained, before the lime is added.* To the clear liquid described, add the stone lime, previously weighed out, and while it is slaking keep well stirred. The completed preparation will have the characteristic yellowish-green color of the regular lime-sulphur preparations. Dilute with cold or hot water to the desired point and spray while hot, as directed above for the lime-sulphur wash.

This mixture is decidedly caustic and the usual precautions must be taken to protect the hands and face. Badly infested trees should always receive two sprayings, one in December and the other early in February before the buds commence to swell.

Neither this mixture nor the lime-sulphur wash can be used upon citrus trees or upon evergreens. On account of their caustic properties the use of these preparations is confined strictly to deciduous trees, *i. e.* those which shed their leaves in autumn and become thoroughly dormant during the winter months.

This mixture, as well as the lime-sulphur preparation, should be strained after being diluted and before being placed in the spray tank. A suitable strainer for this purpose is shown in Figure 14 and can be made from an ordinary wooden bucket by screwing a piece of one or two-inch gas pipe into the bottom and inserting a piece of wire cloth (having about 18 or 20 meshes to the inch) in the bucket itself.

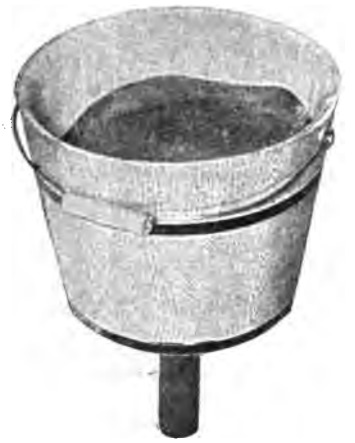

FIG. 14.—A serviceable home-made strainer for straining lime-sulphur mixtures. Made by placing wire-cloth in an ordinary water bucket and inserting a piece of gas pipe in the bottom. (From a photo by W. E. Britton, Conn. Exp. Station.)

WHEN TO SPRAY.

For full and satisfactory control of the San Jose scale winter spraying alone must be depended upon. Although reference is made upon a subsequent page to "summer treatment," the latter does not result in more than a checking of the rate of increase and cannot in any sense be considered a remedy. Spraying of orchards for this pest must be done in winter, and spraying with the lime-sulphur mixture must not be done until the trees have become thoroughly dormant in the fall or early winter. In the case of orchards lightly infested one spraying, if carefully done, will keep the scale in check until the following winter, but where the pest has obtained a good foothold and some of the trees are "incrusted," two sprayings should be given to get the insect fully in subjection and to prevent serious damage to the trees during the ensuing year. When two sprayings are given, the first should be as soon as possible after all the leaves have fallen from the trees and the sap has ceased circulating. The period best adapted for this work in Louisiana is during December. The second spraying should be given late in January or early in February, the object being to put on this application as late as possible so that much of it will remain on until after the scale insects commence breeding in the spring.*

Application of lime-sulphur after the buds have commenced to swell results in these being killed and the crop lost. As peach buds, especially in Southern Louisiana, frequently swell with a warm period in February, the second spraying should be completed not later than February 10th. In orchards where there is but a light infestation, or where the scales have been brought fully under control by two sprayings the previous winter and have not increased to any great extent, one application only is necessary and this should be made late in January or early in February. Where one spraying is depended upon, special pains should be taken to make it thorough. Although the lime-sulphur is sure and certain death to fruit buds that are opening, absolutely no danger to either buds or trees is incurred when the wash is applied to thoroughly dormant trees.

When the scale has once been brought under control by two sprayings during one winter, subsequent control is usually insured by one spraying a year, and where the work has been carefully done we have known orchards to go for two years after spraying without requiring additional applications. In spite of the fact that this preparation will keep the scale fully under control, will prevent injury to the trees by the scale and still permit the production of more and better fruit than is possible in an uninfested unsprayed orchard, the fruit-grower should not entertain the hope that by this spraying he will entirely exterminate the scale. Some few individuals always escape to ultimately reinfest the orchard, and although we have seen several peach orchards in which not a single scale could be found for several months after the spraying, we have yet to find an orchard in which the pest was killed "to stay killed."

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*The lime-sulphur wash is not immediately fatal to more than a small per cent. of the scale-insects but, unlike most insecticides, its action is slow and is continuous for several weeks after its application to the trees. A chemical study of this mixture, made by J. K. Haywood (Journal Am. Chemical Society, Vol. 27, pp. 244-255) showed the completed mixture to contain sulphur as free sulphur and as calcium sulphites, sulphates and the thiosulphate. Upon exposure to the atmospheric conditions after spraying, the thiosulphate gradually decomposes, liberating finely divided sulphur and sulphites, the final result being free sulphur and calcium sulphate. The finely divided mineral sulphur is thought by the author quoted to be the effective agent in killing the scale-insects.

The lime-sulphur wash is destructive to such insects as the cherry scale and Putnam's scale, which occur in greater or less numbers in almost every orchard, and it undoubtedly kills a great many of the younger peach tree borers. It is also a powerful disinfectant and destroys the spores of the peach leaf-curl disease and of other fungi which do more or less injury and retard the proper development of both trees and fruit. Its beneficial work in destroying these various insects and fungi more than repays its cost, independently of its effect upon the San Jose scale. As a result, infested orchards properly sprayed with the lime-sulphur are often in better condition, and produce more and better fruit, than orchards which are not infested with scale and which are not treated with this wash. Mr. J. H. Hale, one of the most extensive and successful peach growers in the United States, has used this preparation for several years past in his orchards of several hundred acres at Ft. Valley, Ga., and is enthusiastic over the results obtained by its use, both in its effect upon the San Jose scale and in its effect in keeping the trees in much cleaner and healthier condition generally than they otherwise would be.

HOW TO SPRAY AND SPRAYING APPARATUS NEEDED.

In spraying an infested tree the object should be to place an even, uniform coating of the wash over every particle of bark that is above ground. Peach orchards should be pruned before spraying rather than afterwards as the pruning lessens the area upon each tree to be covered with the spray and also leaves the balance of the tree more accessible to the operator. With the lime-sulphur mixture a Vermorel or Mistry nozzle is preferable to any other and it should have a medium-sized aperture through which the spray is discharged. A nozzle with too large an opening results in a waste of the spraying material, while one with too small an aperture is usually responsible either for lost time or the application of an insufficient amount of the mixture. In spraying a tree the spray should first be directed against the uppermost and outermost tips of the twigs and these followed down to the trunk, moving the nozzle slowly to secure a uniform and even distribution of the spray on every bud and particle of surface.

After all the twigs and limbs have been treated in this manner the trunk itself should receive a thorough coating. As the operator sprays, it is necessary for him to move around the tree so as to coat each limb and twig upon all sides. While it may appear to the reader that to spray a tree in this thorough manner would require considerable time, as a matter of fact, one who is accustomed to "handling the nozzle" will spray an ordinary sized peach tree in from one to two minutes. Spraying in a strong wind cannot be done satisfactorily, but where there is only a light breeze the operator will soon learn that by commencing with the nozzle directed against the wind, but at an angle to it, he can move around the tree and reach every side of it without being compelled at any time to get directly upon the leeward side of the tree where the spray will be blown upon him.

The lime-sulphur, in order to be an effective agent against the scale-insect and to penetrate the scale-covering, must of necessity be strong and corrosive in its action and if the operator's face and hands are continually wet with it they will become sore. For this reason the operator must guard aginst the spray being blown into his face, or if careless, should protect his face with a mask of heavy cloth. The fittings of the hose and nozzle should be kept tight so that the liquid will not be continually leaking out and getting upon the hands of the operator. A pair of cheap leather gloves forms an effective protection for the hands.

After the first application has dried upon the trees, the latter appear as if covered with a coating of white lead, and all spots that have been missed in the spraying are easily seen. The orchard should now be gone over again the second time and all of these unsprayed spots properly coated with the wash.

In the choice of spray pumps the orchardist has a wide variety from which to choose, and the pump decided upon for the work should be dependent largely upon the number of trees to be treated. A cheap, flimsy affair of tin or copper, such as is used by many gardeners, cannot be used for the application of the lime-sulphur, for, in the first place, copper is entirely corroded and eaten up in a short time by this mixture, and, in the second place, these cheap pumps are so constructed that the

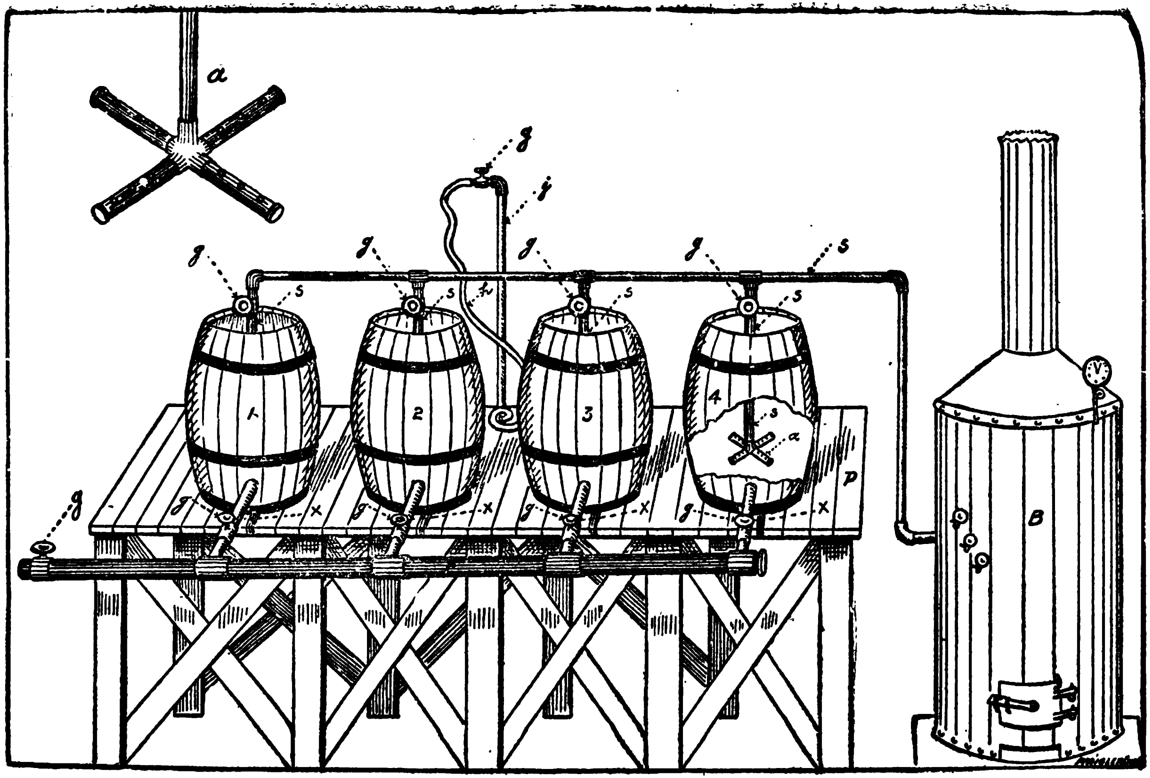

FIG. 15.—A Simple Steam Boiling Outfit for Preparing Lime-Sulphur Washes: *B*, boiler; *ss*, steam pipes; *gg*, globe valves; 1, 2, 3 and 4, 50-gallon barrels; *xx*, pipes for drawing off mixture after boiling; –, large pipe carrying liquid from pipes to wagon tank or spray-barrel; *a*, lower end of steam-pipe with cross-arms and one-eighth inch openings for escape of steam; P, platform 6 feet above ground; *f*, pipe supplying water from elevated tank or steam-jet; *h*, water hose for carrying clear water to 1, 2, 3 and 4. (After Newell & Smith, Bul. No. 14, Ga. State Board of Entomology.)

spraying material invariably gets all over the operator and through his clothing. The use of such pumps under any circumstances for spraying any material whatsoever is only a make-shift that can hardly be commended.

The use of knapsack pumps with the lime-sulphur is not practicable.

For use with the lime-sulphur wash a substantial, well-made pump of brass should be used and it should in all cases be equipped with a long line of hose and an extension pipe so that the operator can conveniently reach all parts of the trees or plants to be sprayed.

In private grounds and in small orchards a bucket pump, costing in the neighborhood of $7.00 o $9.00, is amply sufficient for the work when properly provided with hose and pipes. As sent out by the factories, these bucket pumps are equipped with a three-foot length of hose to which the nozzle is attached. To spray tall orchard trees with such an outfit is impossible. However, the short length of hose can be removed and a hose ten to fifteen feet in length can be substitued. To the distal end of the hose an extension pipe (which need be nothing more elaborate than a length of ordinary iron gas pipe upon which threads are cut for screwing on the nozzle) should be attached and on the end of this the nozzle should be placed. Almost any factory or dealer in spraying machinery will furnish bucket pumps equipped in this manner if requested to do so. While such an outfit can be used by one man working alone, better and more satisfactory spraying can be accomplished by two. In the latter case one man can pump while the other directs his entire attention to the use of the nozzle, the long lead of hose and extension pipe (which latter should be about six feet in length), permitting him to move about with perfect freedom and reach all parts of the tree. An outfit of this kind is shown in Figure 10.

In orchards of over one or two hundred trees the spraying can be carried on much more rapidly by the use of a barrel pump, costing from $12.00 to $20.00. While the bucket pump outfit can of course be used for spraying any number of trees, still the use of a barrel pump equipped with two leads of hose and having a capacity of about 50 gallons at each filling affects such a saving of time that its use is economical in the end. Like the bucket pump, the barrel pump should have all fittings perfectly tight and should have leads of hose from twenty to twenty-five feet in length to which extension rods are attached. Where an extension rod is not readily obtainable a wooden pole may be tied to the hose near the nozzle, and will answer the same purpose as a regular extension pipe, although by no means as convenient and easy to handle.

In very large orchards it is customary to mount the spray pumps in wagon tanks having a capacity of from 200 to 300 gallons so that one load of spraying material will last from two to three hours. This, of course, affects a material saving in time lost by the spray hands. These wagon tanks are not expensive, costing from $10.00 to $20.00, but unless the orchard to be sprayed contains several thousand trees the purchase of such a tank by the fruit-grower is unnecessary.

After each day's spraying the pumps and attachments should be well rinsed out with clear water and after the season's spraying is completed all parts of the pump should be thoroughly cleaned and oiled before being stored away.

The fruit-grower may occasionally encounter difficulties which are not fully covered in this short discussion of spraying materials and methods. In all such cases the writer will take pleasure in answering fully, free of charge, any inquiry that may be made.

Summer Treatment for the San Jose Scale.

As was stated upon a previous page, substances which are corrosive enough in their action to kill the San Jose scale are too strong to be applied to trees while they are in a growing condition. For this reason no treatment is known that will control the San Jose scale effectively, if applied while the trees are in leaf or fruit.

In case of infestations which are discovered in mid-summer and where the infestation is so bad that it appears unlikely that the trees will survive until winter treatment can be given them, the regular lime-sulphur wash described above can be made and applied to the trunks of the trees and to the bases of the lower limbs with a whitewash brush (but must not be applied to the foliage or young growth). This will check the increase of the scale upon these portions, where it is usually most abundant, and will be of assistance to the tree in resisting the damage by the pest until winter, when a thorough treatment can be given. In some cases the application of a 15 per cent kerosene emulsion* (to the entire tree, foliage and all) will kill all young lice and some of the older insects as well, but in the course of a couple of weeks after spraying the young lice are again as abundant as ever, and such sprayings, to have any material effect upon the scale, must be repeated every two or three weeks until the end of the season. Any summer treatment that may be undertaken should be considered as no more than an agency in reducing the rate of multiplication of the insects until a thorough spraying with the lime sulphur can be given during the winter following.

Manufacturers of, and Dealers in Spraying Machinery.

For the convenience of those who contemplate the control of this or other fruit insects upon their premises, we give below a list of some of the manufacturers and dealers in spraying machinery. The fruit-grower who has in mind the purchase of a spraying outfit will do well to secure catalogues from several of these firms and from these he will be able to obtain much information regarding spraying machinery and will be enabled to select an outfit suited to his particular requirements:

Goulds Manufacturing Co., Seneca Falls, N. Y.
The Deming Company, Salem, Ohio.
Morrill & Morley, Benton Harbor, Mich.
Field Force Pump Co., Elmira, N. Y.
F. E. Myers Pump Co., Ashland, Ohio.
Wm. Stahl, Quincy, Ill.
Spray-Motor Co., Buffalo, N. Y.
Beck & Gregg Hardware Co., Atlanta, Ga.
P. J. Berckmans Co., Augusta, Ga.

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*Kerosene emulsion can be made from 2 pounds of whale-oil (or good laundry) soap. 4 gallons of water and 8 gallons of kerosene as follows: Weigh the soap carefully and place with the water in a vessel over the fire, using a slight excess of water to make up for evaporation. Fit a pump with a straight piece of hose, to which is attached a nozzle for throwing a straight stream 3-16 or 1-4 inch in diameter. Pour the oil into a barrel or tub in which the pump is set and when the soap is dissolved and the solution begins to boil, add it to the oil (away from the fire) and pump the whole vigorously back into itself for a period of at least ten minutes. The stream from the nozzle should be directed straight downward into the mixture so as to agitate it to the very bottom. After a few minutes the oil and soap solution will be seen to combine, forming a thick creamy solution which when perfectly made will remain without change for several days. For a 20 per cent. strength add water to make a total of 40 gallons: for a 15 per cent. strength add water to make 54 gallons, and for a 10 per cent. strength add water to make 80 gallons and agitate thoroughly before use.

RULES AND REGULATIONS OF THE STATE CROP PEST COMMISSION OF LOUISIANA,

Governing the Inspection of Nurseries and the Shipment of Fruit Trees and Other Nursery Stock Into or Within the State..

For convenient reference, we give below such Rules and Regulations of the State Crop Pest Commission* as provide for the inspection of nurseries offering nursery stock for sale in the State of Louisiana, and such Regulations as govern shipments of nursery stock into this State from other States or countries. A full copy of all the Regulations of the Commission may be obtained free of charge upon application to the Secretary of the Commission.

"SECTION VIII.

"(a) No firm, person or corporation shall sell, ship, exchange, deliver or give away, within the State of Louisiana, any trees, vines, shrubs, buds, cuttings or plants, or parts of plants, known to be infested with the San Jose scale.

"(b) All nursery stock shipped into this State from any other State or country shall be prominently labeled with a certificate of inspection signed by the State Entomologist or other duly authorized official of the State or country in which said stock was grown. Shipments not so labeled shall be liable to confiscation upon the order of the Entomologist of the Crop Pest Commission.

"(c) Transportation companies and their agents shall immediately notify the Secretary of the Crop Pest Commission (Shreveport, Louisiana), when by oversight, negligence or otherwise, any shipment of nursery stock without a proper certificate attached, shall arrive at any station or wharf in this State, and it shall be the duty of the Secretary to proceed as speedily as possible, by himself or his assistant, to investigate and dispose of such shipment.

"(d) The Entomologist and his assistants shall have authority to inspect any shipment of nursery stock at any station or wharf in this State, and shall have authority to stop any nursery stock when in transit, for the purpose of inspecting the same, regardless of whether such stock shall bear a certificate of inspection or not. The Entomologist shall have authority to seize, condemn and destroy any nursery stock infested with San Jose scale or other seriously injurious insect or disease, found within the confines of this State.

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*The Rules and Regulations of the Crop Pest Commission are enacted, and amended from time to time as occasion requires, in accordance with Act No. 6 of the Extra Session of the Louisiana Legislature, approved December 15, 1903, and said Rules and Regulations have the force of law. Violation of any Rule, Regulation or Order of the Crop Pest Commission is punishable by fine or imprisonment.

"(e) Each and every person, firm or corporation growing nursery stock for sale in this State shall apply to the Secretary of the Crop Pest Commission for inspection on or before July 1 of each year. It shall be the duty of the Secretary to inspect such nursery not later than November 1st. If upon such inspection the nursery stock and premises be found apparently free from the San Jose scale and other seriously injurious insects and plant diseases, a certificate shall be given to that effect. On and after August 1, 1905, a copy of said certificate bearing the seal of the Crop Pest Commission and the *fac-simile* signature of the Secretary, shall be attached to each and every box, bundle and package of nursery stock shipped within this State. Shipments of nursery stock not so labeled shall be refused for shipment by all common carriers and their agents, and such stock if found in transit or in the possession of any common carrier by the Entomologist or his assistants, shall be liable to confiscation.

"(f) No firm, person or corporation shall sell, give away, exchange or deliver, within this State, any trees, vines, shrubs, or plants, commonly known as nursery stock, without same having attached thereto in a prominent manner, a copy of the certificate of inspection signed by the Secretary of the State Crop Pest Commission, or by the State Entomologist or other duly authorized official of the State or country in which said nursery stock was grown.

"(g) The Entomologist of the Commission shall have power to require any one in the State to fumigate his trees, shrubs or plants with hydrocyanic acid gas or other substance, when, in his judgment, such treatment is necessary or advisable for the proper protection of the agricultural or horticultural interests of the State or of any section thereof."

Directions for Sending Insects for Identification.

The Entomologist of the Commission is at all times glad to render (always free of charge) every assistance possible in determining the identity of insects and plant diseases and advising measures for their control.

Do not send insects in envelopes or pasteboard boxes by mail; they are inevitably crushed beyond recognition. Send living insects in strong *wooden* or *tin* boxes by mail. No openings are necessary to admit air. Whenever possible enclose some of the food-plant for the insects to subsist on while en route; specimens showing the injury done are desirable. *The name and address of sender should be on every package.* It is against the postal regulations to inclose a letter in a box by mail unless sent at letter postage rate. Specimens of caterpillars, worms, etc., in alcohol or other liquid can be sent by mail *only when in regular mailing tubes.* We will be greatly aided if correspondents writing about insect pests will give as full description of the habits, food-plants, injury and abundance as possible.

Specimens of twigs, living plants with foliage, etc., should be wrapped in damp (not wet) cotton cloth so as to reach us in fresh condition. Fruits showing injury or disease should be wrapped well with paper and packed in a wooden or tin box.

Correspondents can materially aid the work of this office by communicating with us concerning their success or failure in using the methods advised for controlling injurious insects and diseases, giving a careful detailed account of the methods used and the results obtained. Such information will prove of value to all.

The State Crop Pest Commission of Louisiana

Was established by the Extra Session of the Louisiana Legislature of 1903, by Act No. 6, approved December 15th, 1903, for the purpose of promulgating and enforcing Rules and Regulations intended to prevent the introduction and dissemination of insects and diseases inimical to the crops and fruits of the State, to investigate seriously injurious insects or diseases occurring within the State, to devise ways and means for their control or eradication and to publish bulletins and in other ways disseminate information regarding the insects and diseases injurious to fruits, crops, etc.

The Circulars of the Commission are issued from time to time as the result of the various investigations being made and whenever such publication is deemed advisable in order to place reliable information in the hands of planters, fruit-growers and farmers regarding certain injurious insects or diseases. These Circulars are sent free of charge to all farmers and fruit-growers in the State who make application therefor. Applications for these Circulars, as well as for copies of the Regulations of the Crop Pest Commission, or of the Act No. 6 establishing the Commission, when these latter are desired, should be made to the Secretary of the Commission (Shreveport, La.).

Circular No. 3, November, 1905, contains a discussion of the cultural remedies to be used against the cotton boll weevil and should be secured by every cotton planter and farmer in the State of Louisiana.

CIRCULAR NO. 6

OF THE

State Crop Pest Commission

OF

LOUISIANA.

A Preliminary Report on the Horseflies of Louisiana With a Discussion of Remedies and Natural Enemies.

BY

JAMES S. HINE.

ISSUED UNDER THE DIRECTION OF THE

STATE BOARD OF AGRICULTURE AND IMMIGRATION.

CHAS. SCHULER, Commissioner.

BATON ROUGE
THE TIMES, OFFICIAL JOURNAL OF LOUISIANA.
1906.

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State Crop Pest Commission of Louisiana.

ORGANIZATION.

HON. NEWTON C. BLANCHARD, Governor of Louisiana, Baton Rouge.

HON. CHAS. SCHULER, Commissioner of Agriculture, Baton Rouge.

PROF. W. R. DODSON, Director of Louisiana Agricultural Experiment Stations, Baton Rouge.

HON. L. S. FRIERSON, Frierson.

HON. B. W. MARSTON, Eastpoint.

WILMON NEWELL, Entomologist of Louisiana Agricultural Experiment Stations; Secretary and Entomologist of the Commission, Baton Rouge.

J. B. GARRETT, C. W. FLYNN, E. C. COTTON, HARPER DEAN, JR., Assistant Entomologists and Inspectors, Baton Rouge.

MISS L. E. RENNEKER, Clerk and Accountant, Baton Rouge.

INTRODUCTION.

Among the many injurious insects with which the farmers and planters of Louisiana have to contend, few are of more importance than the insects known as horseflies, deerflies and earflies. All of these flies, belonging to the group of insects known to entomologists as the Tabanidæ, at times reach enormous numbers in parts of Louisiana. In fact, it is doubtful if any of the scientists who have touched, in their publications, upon the importance of these insects, or upon their role in the dissemination of disease, have had even a remote conception of the enormous numbers of these flies which at times infest certain of the coast and alluvial sections of Louisiana.

Aside from their direct damage in reducing the flesh of the animals attacked and in preventing the growth of young stock, these flies are instrumental in the dissemination of anthrax, or charbon, a disease which has from time to time during the past one hundred years or more, ravaged the herds of Louisiana and stood as an almost insurmountable barrier to the successful and profitable production of beef and dairy cattle, which the climate and abundant forage of the State would otherwise make possible.

While charbon outbreaks usually originate by an animal obtaining, while grazing on infected pastures or headlands, the spores of the disease, its further dissemination to plantation feed lots and stables is almost entirely through the agency of these flies, which, after feeding upon either the diseased live animal or upon the cadaver, fly to animals throughout the entire neighborhood, carrying with them the anthrax spores and bacilli.

Could the horseflies be exterminated in any given locality, or even considerably reduced in numbers, the control of this disease and its ultimate eradication would be rendered much easier than at present.

The first step looking to the successful control or eradication of any insect must be the acquisition of a thorough knowledge regarding its life history and development. The development of the horseflies (and other flies of the same family) is somewhat complicated, and the determination of the various stages requires long and tedious study and observation.

Despite the great economic importance of this group, but little is known regarding the various species and regarding means by which they may be controlled.

Perhaps the most valuable acquisitions to our knowledge of these insects during recent years have been those resulting from the investigations by Prof. James S. Hine, of the Ohio State University. Mr. Hine has made a special study of them in different States for several years past, and has not only described many forms hitherto unknown, but has successfully worked out the life histories of a considerable number of species.

As a preliminary step towards finding suitable measures for reducing the numbers of these insects, the State Crop Pest Commission, in co-operation with the Gulf Biologic Station, secured the services of Mr. Hine during the summer of 1905 in making a study of the horseflies of Louisiana.

The results of Mr. Hine's work are given in this paper, which is being published concurrently as Bulletin No. 5 of the Gulf Biologic Station of Louisiana, under the direction of Director B. H. Guilbeau.

WILMON NEWELL,
Secretary, State Crop Pest Commission of Louisiana.
Baton Rouge, La., Feb. 15, 1906.

PREFACE.

This paper is my report to the State Crop Pest Commission and Gulf Biologic Station of Louisiana, by whom I was employed during a part of the summer of 1905. During most of my stay in the State I was located at the Gulf Biologic Station, on the gulf coast, about thirty miles from the Texas State line. Mr. Wilmon Newell, Secretary of the Crop Pest Commission, and Prof. B. H. Guilbeau, Director of the Gulf Biologic Station, showed me every consideration, and it was on account of their interest and suggestions that the work was undertaken. I desire to express my appreciation, not only for what these two gentlemen have done, but also for what many of their associates have done to aid the progress of this work.

The drawings, with the exception of those of *Chrysops* and those otherwise accredited, were made by Miss Lumina C. Riddle, of Columbus, Ohio.

JAMES S. HINE.

Columbus, Ohio, February 1, 1906.

State Crop Pest Commission

OF LOUISIANA.

CIRCULAR NO. 6. FEBRUARY, 1906.

The Circulars of the State Crop Pest Commission are sent free of charge to all farmers and fruit growers of Louisiana who make application therefor.

A Preliminary Report on the Horseflies of Louisiana, With a Discussion of Remedies and Natural Enemies.

BY JAMES S. HINE.

A paper on the horseflies of the State of Louisiana at the present time must necessarily be incomplete, as only a little time, comparatively speaking, has been put on the subject, and, what is more, the various species wherever found are difficult to make observations upon since the flies in all stages are rather retiring in their habits. The life of the larva is passed in the water or in the ground, and the pupa is difficult to find, and, moreover, when the adult appears it flies so rapidly, and most of the time in such secluded places, that it is seldom seen except when it alights on animals for the purpose of biting in order to procure food. Then again, the life cycle often occupies

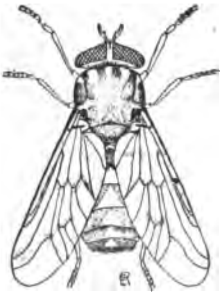

FIG. 1.—Autumn horsefly *(Tabanus sulcifrons)*, female, natural size.

a whole year, and sometimes more; and as even an approach to the conditions of the natural habitat and food of the larva is difficult to attain and perpetuate for any length of time by artificial means, the rearing of the various species under observation can not be otherwise than a very tedious undertaking.

Various common names, such as horseflies, gadflies, deerflies, dogflies, earflies and woodflies,* are applied to these insects in different sections of the country. They belong to a single family called Tabanidæ, and all of them are of medium to large size, with wings either transparent or clouded, or spotted with black or brown.

They are of especial interest to the economic entomologist, the farmer and the stock raiser on account of their blood-sucking propensities and the injury and annoyance they cause to domesticated animals on account of this habit. Not only are horses attacked, but cattle, hogs and sheep as well, although the latter are more or less protected by their wool, which to some extent acts as a blanket over most of their bodies.

All through the group the males and females are easily distinguished from one another by the eyes, which in the male sex are united on the front of the head, while in the female sex there is a rather narrow space on the front of the head separating the eyes from one another. It is worth while to be able to tell the sexes apart, for, like the mosquitoes, it is only the females that suck blood, or, in other words, that are troublesome to stock. The males, and, under certain circumstances, the females also, live on the nectar of flowers or the juices of plants, or on other sweet liquid or semi-liquid substances.

These flies are usually troublesome only when the sun is shining, or at least after eight o'clock in the morning. They rest on foliage or trunks of trees, on posts, stumps, fences or in other inconspicuous places during the night and early morning hours, and then come forth in myriads as soon as the sun warms the atmosphere, to get a meal of blood from any animal that comes in their way; and it seems that the hotter the sun the more active they are, and the more injury and annoyance they cause to farm animals.

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*According to Mr. Harper Dean, Jr., the term "Mayflies" is applied in parts of Virginia to certain species of *Chrysops*.

All the species of horseflies taken so far in Louisiana belong to two genera, *Chrysops* and *Tabanus*. In *Chrysops* ("earflies" and "deerflies") the wings are variegated with black, and the various species are only slightly larger than the common housefly; in *Tabanus* ("horseflies") the wings are hyaline, or generally marked with small black or brown spots, and the species are larger, some of them very large. One or two of the large species have the wings nearly uniformly black all over, and another smaller one has the wings distinctly variegated with black. There is no doubt but that there are two or more other genera in the State that have not been collected, but the ones named above, in any case, include most of the species especially injurious in the United States.

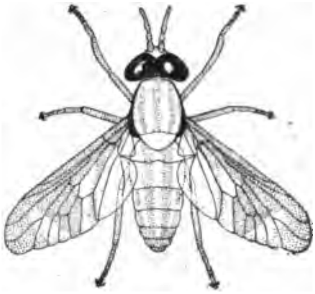

FIG. 2.—Little earfly *(Chrysops pikei)*, male, enlarged to three diameters.

EGGS AND EGG-LAYING IN GENERAL.

All the species of *Chrysops* whose egg-laying habits I know, and many species of *Tabanus* as well, place their eggs over water, while other species of *Tabanus* oviposit on plants standing in wet ground. Some species are very precise in placing their eggs Thus, *Tabanus stygius*, which I have observed many times, follows the interesting habit of ovipositing on the upper surface of the leaves of the arrow plant,* placing the eggs just above the point where the petiole meets the expanded part of the leaf. So closely is this habit followed that a hundred masses of eggs are found thus located to one placed otherwise. Sometimes a mass is observed on the leaf of another plant, but in the same location, and once in a long time eggs are seen in a different position on a leaf.

**Sagittaria* sp.

The black horsefly* is very apt to place its large mass of eggs, containing upwards of 500, in a certain position on a particular species of sedge in low ground near swamps and ponds.

The rather small horsefly known as *Chrysops callidus* arranges her eggs in a single layer on leaves of various kinds of plants overhanging the water of ponds and small lakes.

Chrysops moerens oviposits much like the last, except that the eggs are placed over deeper water. It is not rare to find these eggs on giant sedges standing in four or five feet of water.

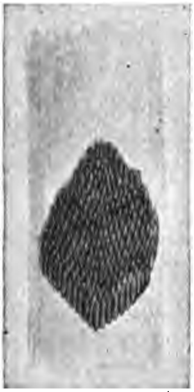

FIG. 3.—Eggs of an earfly, *Chrysops moerens*, enlarged. (After Hart, Bull. Ills. State Lab., Volume IV.)

The eggs when first laid are white in the case of all species thus far observed, but gradually get darker until they become brown or black. The eggs of the various species of *Chrysops* are usually shining black, while those of *Tabanus* are more often clear brown. Thus we see that since the eggs of horseflies are laid on a green surface they form a striking contrast with their surroundings.

It is well known that in some of the flesh-flies or scavengers, the eggs are either hatched, or nearly ready to hatch, when deposition takes place. Not so with eggs of the horseflies, for these do not show any apparent development when first laid; and as about seven days are required for them to hatch under favorable conditions, we are safe in concluding that incubation has not advanced far at the time of laying. It is very interesting to watch a brood of these minute larvae leave the eggs, for they nearly all hatch together, and at one minute a wriggling mass is seen obscuring the egg shells from view, while at the next the hundreds of miniature horseflies loosen their hold on the leaf that supported them and go tumbling down into the water, where they separate, and each henceforth looks after its own affairs. What goes on from this point is more or less vague, but it may be guessed that not all of the individuals from a single mass of eggs ever live to become adults, for there are plenty of animals, large and small, in the water that must find a living, and the horsefly larvae no doubt constitute a fair portion of the food for some of these forms.

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*Tabanus atratus.

THE LARVAE OF HORSEFLIES.

The larvae after hatching from the eggs, as referred to above, grow slowly, feeding on animal life of various kinds, until at the end of several months they become full grown and ready to enter the pupal stage.

The larvæ of the different members of the family are very much alike in appearance, but vary somewhat in color and size, and it is often difficult to distinguish the full-grown larvæ of small species from the young larvæ of the larger species.

When first hatched it appears to be the desire of the larvæ to burrow, consequently, if they are not permitted to get to the mud, they crawl into particles of decaying plants, or anything that may be at hand. The immature stages of many species probably remain in the water, or in the mud very near the edge of the water, during their whole existence as such. The pupæ come to the surface of the ground a few inches from the edge of the water just before the adults issue, and around fresh water ponds at the proper season one may see myriads of pupa-skins of certain species with only their anterior ends projecting above the surface of the ground.

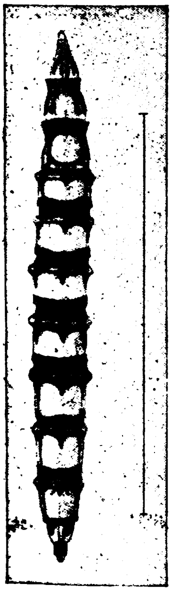

FIG. 4.—Larva of the black horsefly (*Tabanus atratus*), enlarged. (After Hart, Bull. Ills. St. Lab., Volume IV.)

Information at hand indicates that there is a wide variation in the habits of various species, for besides finding the larvæ in water and in mud close to water, they are found oftentimes in dry ground long distances from water. Although very young larvæ do not take kindly to artificial conditions, older specimens are easily kept in breeding cages, and in all cases observed, live as well in ground slightly moist as they do in mud. They eat small soft-bodied invertebrate animals of many kinds, not excluding members of their own family, or even of their own species. In artificial rearing of these insects small earthworms seem to answer well as food for the larvæ.

It is always necessary to keep each specimen in a separate dish or breeding cage, for if two are placed together one is almost sure to devour the other in course of time. One hardly ever fails to obtain the adult fly if older larvæ are taken and proper attention given.

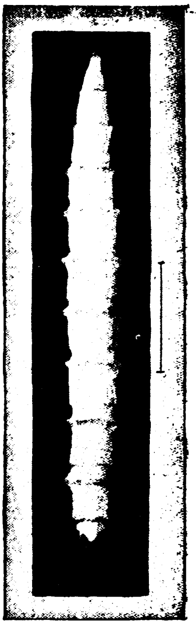

FIG. 5.—Larva of the striped earfly (*Chrysops vittatus*), enlarged. (After Hart, Bull. Ills. St. Lab., Volume IV.)

THE PUPA.

The pupae in all species I have seen are dull yellowish in coloration, with an encircling row of spines or stiff hairs at the apical third of each abdominal segment. This stage is also much the same in appearance in the different species, but there is a striking difference in size, and this is of more consequence in the pupa than in the larva, for in the larva difference in size may indicate different ages of the same species as well as different species, while difference in size of the pupa may be taken to indicate different species only.

Characters for distinguishing the pupæ of different species are found in the external breathing organs, or spiracles, and in the teeth-like appendages located at the apex of the abdomen.

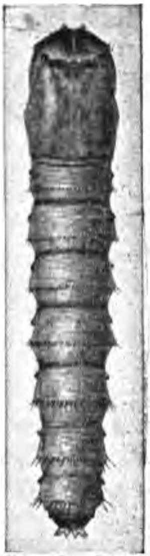

FIG. 6.—Pupa of the lined horsefly (*Tabanus lineola*), enlarged. (After Hart, Bull. Ills. St. Lab., Volume IV.)

If one attempts to find pupæ of horseflies, he is not usually successful, for it is not certain that they will be found in any particular place any more than in some other place. On account of the hairs and spines with which they are clothed, the soil sticks to them more or less, causing them to have the same general color as the ground in which they occur, so that they are very easily overlooked.

ON THE LIFE HISTORY OF THE STRIPED EARFLY.

(*Chrysops vittatus* Wiedemann.)

This is a common species in Louisiana, for which reason its life history may be properly considered in this paper. Personally, I have not worked out the life history of this particular species fully, so it seems best to quote as follows from Hart's paper "On the Entomology of the Illinois River and Adjacent Waters," published in Volume IV of the Bulletin of the Illinois State Laboratory of Natural History, Page 228:

> **"The larvae were found in connection with other larvae in a weedy and swampy brook. They were quite common, occurring in the mud and the mats of dead stems, and rarely floating at the surface. The first were seen March 28, but they continued to occur up to April 15, increasing slightly in size. In the breeding cage they burrowed into the mud and vegetation. In the latter part of May the water was allowed to dry up, and on the 28th, all that remained was poured off. June 1 to 3, three pupae were formed in the damp mass of dead vegetable matter resting on the mud in the cage. Two imagoes emerged June 9, both males, the third failing to transform. The coloration of the larva readily distinguishes it.**
>
> **Length of larva, 10 to 15 millimeters, diameter 1.6 millimeters. Head light-colored, mouth parts pale, tips of maxillary palpi in line with the end of the labrum; body whitish, a mottled appearance within at middle of body.**

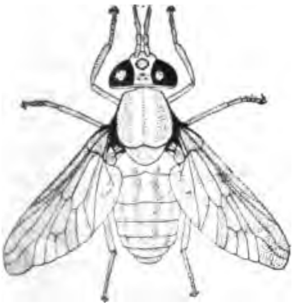

FIG. 7.—Striped earfly (*Chrysops vittatus*,) female, enlarged to three diameters.

Dorsal and ventral areas striate, striae entire, distinct, and not very fine; lateral striation a little finer, that of the prothorax very fine, with a small smooth spot adjoining the smoother surface of its ventral area; latter shorter than dorsal, not including anterior pair of setae, medium sulcus scarcely dull pubescent. Meso- and metathorax with lateral impressed lines, and dull pubescent pale annuli, but the lateral lines almost without pubescence. Fleshy false feet of abdominals rather prominent, dorsal pair united into one, there being no narrowing near the median line; annuli very pale, except on the last two or three segments; last segment white basally, remainder covered with a dull blackish microscopic pubescence reaching forward to the anal prominence, a triangular extension each side of middle above, often a small spot accompanying each; respiratory tube whitish, spine sometimes projecting.

Length of pupa 9-10 millimeters, diameter 2 millimeters. Light brown ferruginous, obsoletely transversely wrinkled, head and thorax shining, abdomen duller.

Antennal sheaths not very thick at the base, surpassing the marginal angulation above them; carinated tubercles not prominent, lateral notches broad and shallow, palpal sheaths indefinite, rather distant; setiferous tubercles scarcely darker; ocellar tubercles replaced by pale dots. Rima of thoracic spiracles strongly elevated from the inner side, so that the top of the prominence is nearly vertical, the upper edge of the rimal border forming a sharp carina and its anterior extremity ending at the tip of the marginal extension in an acute angle; the free lower edge is crossed by sharp ridges, giving it a separate profile; rima less curved at middle, more strongly at each end, scarcely hooked; inner notch with radiating striations.

The abdominal fringes consist of a single row of pale spines on each segment, rather long except dorsally on the second, where they are shorter and thicker. The abdominal spiracular tubercles arise from a single elevation, tapering from a comparatively small base as far as the middle, thence nearly cylindrical to the apex, which bears a subcircular rima; tubercle about as high as its basal diameter. Last segment with six nearly equal terminal teeth, their points marking the angles of a hexagon; slender, even constricted at the base, twice as long as their diameter near the base. Lateral spines almost wanting; ventral fringe in front of anal tubercle in the male; a tuft of about five spines on each side in place of this in the female."

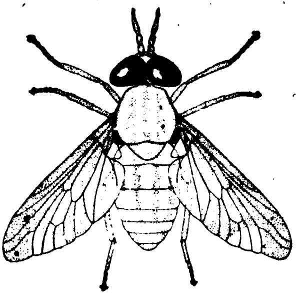

FIG. 8.—Striped earfly (*Chrysops vittatus*), male, enlarged to three diameters.

THE LIFE HISTORY OF THE BLACK HORSEFLY.

(*Tabanus atratus* Fabricius.)

This is a common species over a wide range of territory, and has been taken in several sections of Louisiana. In many places it is called the black gadfly, and I have often heard the name "bonepicker" applied to it. This latter name is suggested, I suppose, on account of the ability it exhibits for biting animals in general. It is such a common insect that one might suppose that every item of its life history is definitely known, but such is not the case. It is easy enough to find the eggs in season, and from these it is easy to get the young by hatching, but on account of its long larval period the intermediate stages between the very young and the mature larvae seem not to have been observed. The mature larvae have been collected by many observers and in a variety of places. The first ones were found in rotten logs, and for a time it was thought that they were found only in such places; but they may be procured by digging in the ground in the vicinity of ponds, under stones on ditch banks, taken from the water with dip nets, picked up while swimming on the surface of the water, and frequently in the most unexpected places.

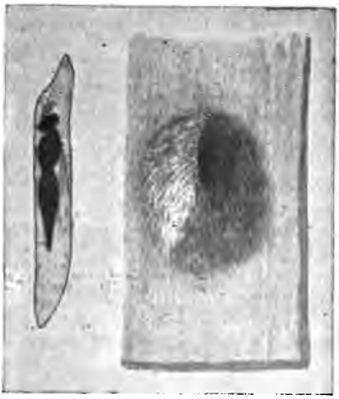

FIG. 9.—Egg-cluster of black horse-fly *(Tabanus atratus)*, with a single egg showing a parasite within: enlarged. (After Hart, Bull. Ills. State Lab., Volume IV.)

They seem to remain on the surface of the water with the utmost ease, and move from one place to another by their own efforts, as they can swim much faster than they can crawl when on dry land. They are, no doubt, carried for long distances during periods of high water, either unprotected or in old logs, pieces of rotten wood or in fact in any plant remains of capacity enough to harbor them. Their appearance in places distant from water may often be explained by their transportation during overflows, and it is safe to suppose that the wide distribution of the species is in a measure due to its distribution by the waters of rivers and creeks. It seems probable to me that many larvae reach maturity miles from where they were hatched, and that a mass of eggs placed on a leaf overhanging the waters of such a river as the Mississippi might produce adults for several different States.

Larvae in the breeding cages stop eating in late fall, even though they are kept at a temperature as high as is normal for the summer months. This may be taken as an indication that they hibernate during the winter months when compelled to do so. I have spent some time in trying to gather data on this point, and have found the larvae of the species under consideration in more or less exposed places repeatedly, at the beginning of winter. I have not succeeded in finding them in a frozen condition, as I have larvae of other insects, but there is no doubt that they are often caught by winter frosts in northern climates, and in case they are there seems to be no reason why they should be injured thereby any more than the larvæ of the moths and butterflies. So far as my observation goes, all species of horseflies pass the winter in the larval stage; therefore, the effect of cold on this stage is a subject that should be thoroughly investigated.

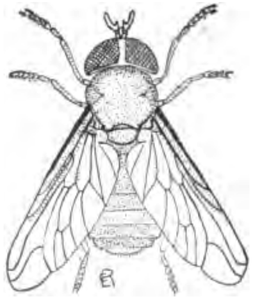

FIG. 10.—American horsefly (*Tabanus americanus*), female, natural size.

The keeping of the larvæ at ordinary living temperatures all through the winter months does not seem to hasten materially the appearance of the adults in the spring. In many trials with different species in breeding cages I find that the flies issue at about the time that those matured under natural conditions are appearing on the wing. Of course under natural conditions the adults issue continuously over a period of several days, and in some cases over several weeks, so that a comparison like the one just given may be much in error, for the specimens reared in the cages might have appeared naturally toward the latter part of the normal period of emergence.

The eggs are placed in masses of varying size on leaves or stems of sedges and other plants growing in marshy or wet ground, but not necessarily overhanging the water. Single masses may contain as many as 500 eggs, but oftentimes they are much smaller. The egg mass is brownish in color permanently, but when first placed is white, and very convex, being composed of four or five layers of eggs one above the other. Each egg is elongate spindle-shaped, between two and three millimeters in length, and irregularly narrowed at each end. The eggs hatch in about nine days in all cases so far observed.

At first the larvæ are about four millimeters in length, as near as the measurement can be taken, smaller in diameter than an ordinary pin, and pointed at each end. They are colored much like the mature larvae, but if anything the black markings of the body are not so pronounced.

They grow slowly and seem able to pass comparatively long periods without food, but when food is at hand appear to eat almost all of the time. When full grown they measure something like fifty millimeters in length and five or six millimeters in diameter. It is difficult from their general appearance to tell which is the head, for they are pointed at both ends and the body is not plainly differentiated into thorax and abdomen. All the segments for the whole length of the insect telescope on one another, so that it is difficult to give an exact length or diameter. The head end may be located by the direction in which the larva crawls, if in no other way, and the mouth parts will be found to be peculiar and very small. The mandibles consist of two strongly chitinized hooks, and work by being moved endwise, backward and forward. When drawn in the anterior ends point directly forward, but when protruded these same ends point downward and backward, thus forming a pair of hooks by means of which the larvæ hold their prey, consisting of a variety of invertebrates of various sizes. They are able to protrude these mandibles very quickly, and when they strike a hard object a grating sound is produced. A careful study of the food of the larvae of horseflies is of more than ordinary interest, since it is claimed by some that, as they are predaceous, they may take enough injurious species to admit them to the roll of beneficial insects.

The color of the full-grown larva is dull whitish in general, but there is a conspicuous band of black or dark brown at the union of each two segments. For part of the length the bands of black are but slightly narrower than the others.

In the species under consideration the pupa stage was reached by the middle of May, or before, and lasted about two weeks. It is likely that the change to the pupa occurs much earlier in Louisiana than in Ohio. It may be best to state here that this horsefly is a species which occurs almost continuously during the summer season, so that the date of pupation probably varies with the specimens without regard to seasons. The pupa of this fly is about an inch and a quarter in length.

ON CERTAIN CONDITIONS PRESENT IN LOUISIANA.

Horseflies appear to be very abundant in Louisiana, especially in certain sections, and in the light of what has been said already there seem to be valid reasons for this condition. An atlas which I use for reference contains this statement in regard to the general relief of the State:

"Remarkably low and level, with slight elevations in the west. About 8,450 square miles are subject to overflow, making levees necessary."

The total area of the State is given as 49,626 square miles, so we have figures to show that one-sixth of the entire State is subject to overflow if levees are not constructed. There are many rivers and small streams in nearly all sections, together with many fresh water lakes, and with the swamps and marshes that go with these, and the isolated depressions filled with water that one often sees in traveling through the domain, we have as favorable breeding grounds for these insects as can be found anywhere.

Some of the area included in the above consideration could be drained, and probably will be some time in the future, but much of it can not be, and, on the whole, it is doubtful if any very large areas will receive relief by drainage, but this remains for future developments to prove.

I have in mind a certain section, not in the State of Louisiana, where mosquitoes and horseflies were exceedingly numerous in past years when the country was being ditched and cleared. At the present time this same section is thoroughly underdrained, no water stands long enough to become stagnant, and these insects are so uncommon that they hardly ever receive consideration. Drainage is a good remedy for horseflies, but there is no use to make such a recommendation for a country where it is impossible to put it into operation.

A section of Louisiana that is especially troubled by horseflies is the section located in proximity to the gulf coast. This whole country is only a few feet above sea level, and the acreage of wet and marshy land is very large. Running nearly parallel to the shore of the gulf is a series of alternating ridges and depressions. The depressions form extensive fresh water marshes, over a part of which the water stands the year round. The rivers that traverse this country are sluggish and at intervals spread out into lakes or extensive marshes. Thus various aquatic animals find conditions to their liking and are present in abundance.

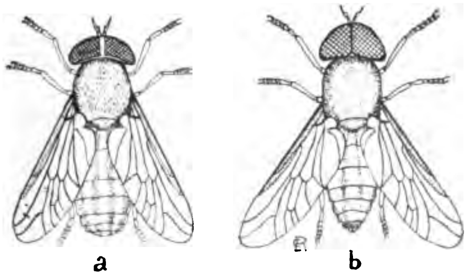

FIG. 11.—Green-head horsefly (*Tabanus costalis*): *a*, female; *b*, male, enlarged to two diameters.

Numbers of cattle and other animals are pastured in this country, the pasturage being furnished both by the marshes and by the higher grounds adjacent. The result is the stock are bitten and tormented by mosquitoes during the night and by the Tabanids and other flies during the day.

THE NATURAL ENEMIES OF THE TABANIDAE.

The natural enemies of this family number several species, belonging to different orders of insects. A knowledge of the life histories and habits of these natural enemies is of value, for the same reason that a knowledge of the life histories and habits of injurious insects is of value. One of the first things attempted when a new insect pest is noted is to work out its life history in detail. When this is accomplished the entomologist is in a position to use his judgment as to when and how insecticides should be applied to give the best results, or if the species is one that will not yield to insecticides, his acquaintance with it will usually give him that information; in other words, a species must be studied in detail before the possibilities connected with its control can be thoroughly and accurately discussed or remedial measures effectively put into practice.

A thorough study of beneficial forms, which include natural enemies of insects, reveals in a sense what they may accomplish under the most favorable circumstances, and, so far as it does this, suggests the advisability of making conditions more favorable for their increase. If a complete account of one of these species is published in an accessible place, acquaintance with it is usually increased, and a general inclination to protect it is in a measure established.

THE HORSE GUARD.

(*Monedula carolina* Drury.)

This species is commonly called horse guard where I have been in Louisiana, but E. S. G. Titus refers to it as the "cicada wasp," and says it has frequently been seen killing cicadas.

Much has been written regarding the habits of the predaceous wasps, and surely they are worthy of every consideration as natural enemies of insects and some other invertebrates. They are considered injurious, beneficial or neutral, according to the habits of the insects or animals they prey upon.

The horse guard has received much discussion from a practical standpoint in some of the agricultural papers, besides being mentioned frequently in entomological journals. While located at the Gulf Biologic Station in June and July, 1905, this species was abundant, and I made some observations on its life history and habits, and especially on the number of flies it carries into a single burrow as food for its young. My attention was first attracted to the species in 1903 at the same place, when, for the first time, I observed the adults flying around cattle and horses. I soon saw what they were after, and that they were expert at catching flies from around these animals. It is somewhat amusing to see how peaceably an animal stands when three or four of the wasps are flying around, each making more noise than a botfly or some of the small Tabanids which they show so much nervousness about.

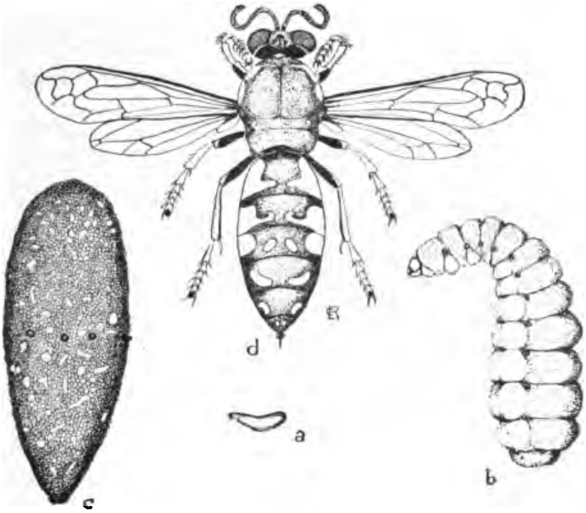

FIG. 12.—Horse guard *(Monedula carolina)*: *a*, egg; *b*, larva; *c*, cocoon; *d*, adult; enlarged to one and a half diameters.

During my stay at the place in 1905 several breeding colonies of the wasps were located and various ages of the larvae were observed in their burrows, together with the remains of flies they had been feeding upon. These colonies were situated in each case on dry ground where the sand was loose and easy to dig, and on the extent of such ground in one place depended the size of a particular colony.

The eggs are white in color, five millimeters in length and about one-fourth as wide; the form is elongate kidney-shape, and at no time were more than two found developed at the same time in the abdomen of the female. The fact that the larva requires a great deal of food makes it impossible for a female to attend very many, and it seems that the number of eggs produced has a relation to the number of larvae that can be taken care of. The egg was not found in place in the burrow, so that mention of some points that it would be desirable to know must be omitted.

The very young larva, not much larger than the egg, was found in the burrow with a single horsefly, but it was not evident whether this fly had been carried in by the female before or after the egg hatched. The different stages of the larva are much alike except for size; the color is white, the total length of the full-grown specimen is considerably more than an inch; it is very large on the posterior half, but narrows in front of the middle, so that it appears as if the small head is situated at the end of a long neck. The enlarged part remains almost stationary when the specimen is feeding, but the narrowed part possesses great extensile and retractile powers, enabling the well-developed mouth parts to come in contact with every part of the fly it is feeding upon. When one locates the larva in its home he finds it surrounded by the remains of the insects that have been placed before it for food, and the one or two fresh specimens which have just been carried in by the industrious mother; the jaws are continually in motion, and it appears so much taken up with feeding that nothing seems to molest it, but specimens do not take kindly to the artificial conditions of the breeding cage. The body is composed of thirteen segments, not including the head; the first three behind the head compose the thorax, but no feet are borne by it; the remaining ten make up the abdomen; ten pairs of breathing pores or spiracles are plainly visible in longitudinal rows, one row on either side of the body; all the segments except the third, twelfth and thirteenth bear spiracles. When it becomes full grown the larva makes its own cocoon of earth and silk, united in such a way that the result is a rather dense structure which appears as if moulded from a poor grade of cement. The cocoon finished, the larva remains in it unchanged for some length of time, just how long I have not been able to determine for several reasons.

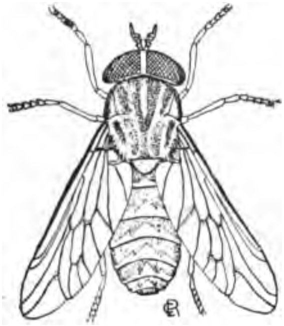

FIG. 13.—Gray horsefly *(Tabanus cymatophorus)*, female, enlarged to one and a half diameters.

The cocoon varies in size to an extent that is quite noticeable, and one is led to suspect that the smaller cocoons contain the males and the larger ones the females. It was proven by several observations that the nests which contained the small cocoons had not received as large supplies of food as those containing the large cocoons, and the smaller ones were noticeably lighter in coloration.

The adult is a conspicuous wasp more than an inch in length, with a well-developed sting which she can use effectively in case she gets in a tight place, but she never attempts to protect her nesting site or her young by stinging the intruder, as some wasps do. Both sexes are black in general coloration, with the legs largely yellow, and small spots on the sides of the thorax and larger spots on the abdomen greenish yellow. Several females may have nests in close proximity to one another, but each attends to its own, and on this account the species is often referred to as a solitary wasp, as distinguished from the the hornets and other wasps which form a group known as social wasps. The nest is a simple burrow excavated in the soft sand by the female herself, at least in cases observed, and in this burrow the egg is laid; when the larva hatches it is fed on flies which she catches and carries to it. Many suppose, when they see this handsome insect flying around horses or cattle, that it is catching food for itself, but in this I suspect they are mistaken, for it is my opinion that the adults feed on the nectar of flowers, on honey-dew from plant-lice and scale-insects and the like, for they commonly visit flowers of various kinds, and they were observed in abundance crawling over the leaves and branches of prickly ash trees thoroughly infested with a common scale- insect (*Ceroplastes cirripediformis*). My belief is that they visited these trees for the purpose of procuring for food the sweet substances which the scale-insects secreted.

It is most interesting to take a position in the midst of a nesting colony of this species and watch the procedure. At first many of the wasps may be seen flying actively on every side, then when all is quiet they settle down to regular routine; some run rapidly over the ground as if searching for the location of their nests, others are making new burrows or cleaning out old ones, while still others appear upon the scene from time to time, each carrying a fly which she takes into her nest as soon as the latter is located and she has satisfied herself that the way is clear. Often a wasp drops her fly for a time, makes an investigation of the surroundings, and then returns and picks it up again.

It appears that when horseflies are to be had the young are fed on them altogether, and as these flies are caught around animals, it is almost always the female, or biting sex, which is taken. The larvae make way with all the soft parts of the flies, but the wings, and very often the head, and more or less of the outer covering are not devoured, so are found in the larval chambers with the immature stages of the wasp. By making a count of the wings of horseflies and other species taken from a single burrow the number of specimens that have been carried into that particular burrow can be determined, presumably with a reasonable amount of accuracy; at any rate, the number can not be overestimated in this manner. The following are records of the counts of material taken from a number of nests:

On July 1 a colony of horse guards was located near the gulf, about a mile to the eastward of the Biologic Station building, and some larvae procured from burrows.

On July 2 Mr. Newell and myself visited this colony, and by means of a wire and hand trowel procured a number of larvæ.

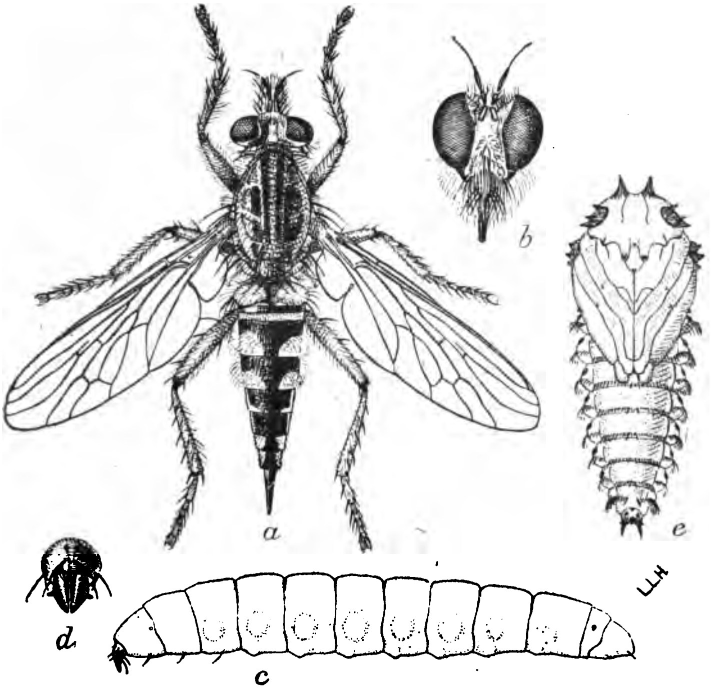

FIG. 14.—A Robber-fly, *Erax lateralis: a,* adult; *b,* face view of the head of adult; *c,* larva; *d,* head of larva; *e,* puparium; all enlarged. (After Titus, U. S. Department of Agriculture, Bureau of Entomology, Bulletin 54.)

In the nests we recognized the remains of three species of horseflies, the screwworm fly and a common green and black fly *(Odontomyia cincta)*.

On July 3 the material found in a single burrow with a nearly full-grown larva was counted, with the result that sixty wings and twenty-three heads of horseflies were found. All the heads were of females.

Another burrow contained ninety-two wings of horseflies and four wings and other remains of *Odontomyia cincta*.

Another contained eighty-two wings of horseflies, but no remains of other species.

On July 4, in company with Mr. W. O. Martin, I visited a colony of wasps on the ridge east of the Station. From a nest containing a large-sized pupa were taken one hundred and ten wings and forty-eight heads of horseflies, but no other insects. The heads in every case were those of females.

On July 5, I counted the remains of insects taken from a burrow which contained a partially grown larva. This count showed forty-eight wings of horseflies and two wings of a large mosquito (*Psorophora ciliata*). Two specimens of the horseflies were fresh and had every appearance of having been but recently brought to the nest.

On July 14, I unearthed a pupa in the southwest corner of the Station field, and found with it one hundred and twenty-two wings of horseflies and two of another fly *(Pseudopyrelia cornicini)*.

Another pupa taken in the same place had in the burrow with it forty-eight wings of horseflies and six of the screw-worm fly.

I also took a male horsefly in a good state of preservation from a burrow containing a partially grown larva. This is the only instance where the male horsefly was observed among remains found in the nests.

Once in a while nests were found in which the larvae were dead; in at least one instance it appeared as though a certain species of little red ant* was responsible for this condition, for numbers of them were feeding in the nest, both on the dead larva and on the remains of insects found with it. The ant was determined for me by Prof. Wm. M. Wheeler, of the American Museum of Natural History.

The nests are not stored and sealed up as is the case with some wasps, but the flies are carried in by the female as they are needed for food. It appears that the burrow is opened, flies carried in and the burrow closed again. How often this operation is repeated I did not discover, but larvae of all ages, as well as pupae, were taken from closed burrows, and in some of the closed burrows nearly fresh horseflies were found, indicating that the opening had just been filled. When the burrows leading down to the larvæ or pupæ were closed they could be followed by the color of the material used in filling, as this

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***Solenopsis geminata* Fabr.

was usually dryer than the surrounding soil. At different times the females were seen filling the burrows as well as excavating them; the quantity of sand removed and the rapidity with which its removal is accomplished can not help but attract admiration for these wasps, especially when it is known that the larval chamber is usually located six or more inches below the surface of the ground.

THE SMALL HORSE GUARD.

(*Bembex belfragei* Cresson).

This is a member of the same family as the last, but is a much smaller insect. So far as observed, its habits and life history are similar; its burrows are made in similar locations and the food of its larvæ is composed of different species of Diptera, a large proportion being horseflies. A difference is noted, however, in the places where it procures these horseflies, for, instead of catching them almost entirely around stock, it picks them up in the marshes and fields, not hesitating to fly out over the water to procure specimens that it finds clinging to grasses and sedges. Therefore the male horseflies are taken much oftener than by the horse guard. In 1903 this species appeared to be much more common than in 1905. It is one that should be widely known and given as much protection as possible.

SAY'S SPOTTED WASP.

(*Crabro 10-maculatus* Say.)

This is another of the solitary wasps which has been observed catching horseflies. Its nest was not located, but it is known that various species of its genus make their nests in woody plants, especially raspberry and blackberry. Peckham found that another wasp of this genus (*Crabro stirpicola*) provisioned its nest with various species of flies.

THE HORSEFLY EGG-PARASITE.

(*Phanurus tabanivorus* Ashmead.)

Some years ago Hart reared this parasite from the eggs of our large black horsefly.* There is probably more than one

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**Tabanus atratus.*

brood of this species in a season, for Hart's specimens issued in August and September, while I have bred specimens which issued in July. This is a very small insect, and passes its immature stages inside the eggs of the fly, one specimen in each egg. At a certain place in Medina County, Ohio, where the eggs of the black horsefly were common, it was found that many of the masses remained plump long after others had shriveled because of the larvae hatching from them. An investigation showed that the former contained many parasitized eggs, some masses having nearly every specimen in this condition. A number were collected and put into small vials, where, in the course of a couple of weeks, hundreds of the parasites issued. What I have observed regarding this minute species proves to my mind that it is of much importance in lessening the numbers of horseflies whose eggs it infests. It has not been observed in Louisiana, but

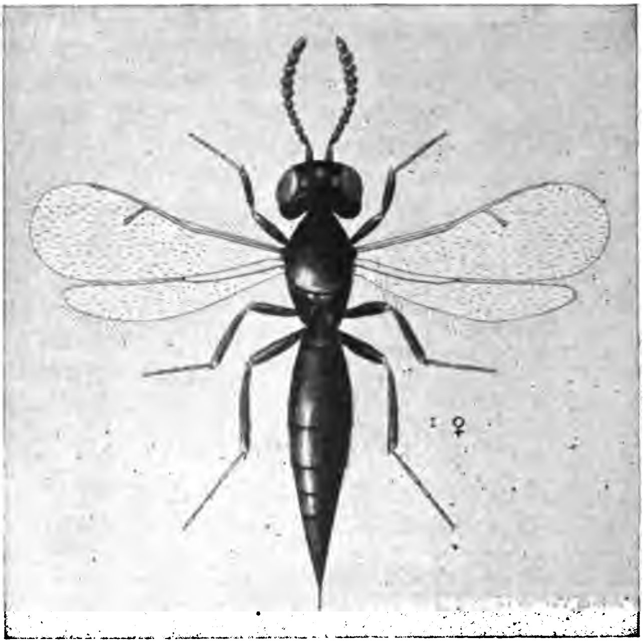

FIG. 15.—Horsefly egg-parasite. *Phanurus tabanivorus,* much enlarged. (After Hart, Bull. Ills. State Lab., Volume IV.)

since its host is common in the State there is scarcely any doubt but that it is there and can be found at the proper season. Another species of this same genus, occurring in Europe, is known to have similar habits.

There are a number of other species of Hymenoptera that have been observed to be natural enemies of the horseflies, and these, as well as the ones mentioned, should receive further study, so that the benefits derived from them will be better understood and the possibilities of utilizing them realized as far as possible.

THE ROBBER-FLIES.

These belong to the order Diptera, as do the horseflies. The robber-fly known as *Erax lateralis* Macquart is common where I have been in Louisiana, and is a regular hawk among insects, frequently capturing the smaller members of the genus *Tabanus,* as well as other insects. It does not appear, however, that the robber-flies are of as much importance in this connection as the wasps, for the reason that the adults do not attend their larvae during growth, and hence capture insects for their own food only. As the robber-fly larvae are predaceous and live in the ground, they have an opportunity to capture other larvae that live in such situations, and therefore they may devour an occasional immature horsefly.

There are scores of species of large flies belonging to the same family as the one just named, and all of them procure their food in the same way that it does. They are cunning insects, remaining perfectly quiet in some inconspicuous place until an insect that they desire for food comes close enough, when they pounce upon it and by means of their strong legs, which are provided with sharp claws, retain it until they introduce their mouth parts and suck away its life-blood. Species of the genus *Deromyia* were especially conspicuous in the fields in the vicinity of the Gulf Biologic Station, and they were often seen capturing horseflies for food.

In a complete report on the natural enemies of horseflies, the large dragon flies and various species of Hemiptera, or true bugs, should receive consideration. Spiders often catch the adult horseflies in their webs, or by jumping upon them from concealment among the foliage. Many birds include them as part of their food, and various insects have been observed feeding on the egg-masses.

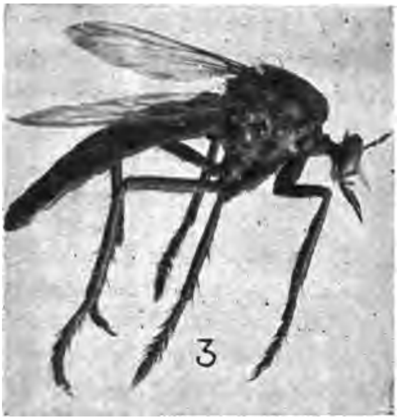

FIG. 16.—A Robber-fly, *Deromyia angustipennis*, enlarged. (After Quaintance and Brues, U. S. Department of Agriculture, Bureau of Entomology, Bulletin 50.)

Before leaving this subject it may be well to give brief consideration to a few species of fishes whose habits suggest that they have some connection with the subject. The top-minnow* was observed to be common in Louisiana in both brackish and fresh water, and is one of the species Dr. L. O. Howard figures in his "Mosquito Book" as feeding upon mosquito larvae. It is not large enough for use as food, but flourishes in small ponds as well as in larger bodies of water, and its small size is an advantage, enabling it to go into the shallowest places. The species is viviparous, each female giving birth to a number of living young, which, it is stated, can be reared with the greatest ease, it being necessary only to keep them in water where they can procure sufficient food. Other fishes closely related to this one have similar habits and should receive attention. Professor Garman reports, in Volume III of the Bulletin of the Illinois State Laboratory of Natural History, that the larvae of horseflies are eaten in quantities by the channel catfish and occasionally by the bull-pout. Various species of sunfish are common in Louisiana waters also, and on account of their strictly carnivorous habits, in most cases at least, they are most desirable. The people should see to it that all permanent waters, no matter of what extent, are well stocked with fishes, not only on account of the larvae of horseflies destroyed by them, but for many other reasons as well.

**Gambusia affinis.*

ARTIFICIAL REMEDIES FOR HORSEFLIES.

Up to the present time no satisfactory remedy applicable in all cases has been suggested, for the habits of the various species are such that it is difficult to suggest anything that can be applied in a practical way.

The method, long in use, of protecting work animals with fly nets meets with quite general satisfaction, and the use of burlap on other choice animals has its merits, but the problem of how to protect the stock in the pastures is the important one, and its solution is not easy. In order to solve this problem a general remedy for horseflies in some stage must be suggested, and since it is the adults that do the damage, a remedy for them is most desirable.

If one takes the time to observe these flies around water when they are plentiful, he soon notices that certain species, at least when flying over the water, drop down now and then and dip their abdomens. Porchinski of Russia explains this habit by saying that the flies come to drink, and that every time they drop down to the surface of the water they take a sip of the liquid. He also made a number of experiments, and proved that by applying kerosene to the surface of standing pools large numbers of horseflies of various kinds got the oil on their bodies while drinking, and were killed. As to the quantity of kerosene required to kill them in this manner, it is stated that he applied about the equivalent of a half-pint to six square feet of water surface. If this was sufficient to do the work, no more oil was applied until the next morning, when a like amount was used. In case the first male horsefly that came to drink did not stick to the surface, more oil was applied immediately. He observed that all the species of *Chrysops* and *Tabanus* which were flying at the time of his experiment were killed by the application. A translation of Porchinski's article, with additional notes by Dr. Howard, is published in Bulletin 20, United States Department of Agriculture, Division of Entomology, 1899. In an investigation of this method I find it has merit in the right place, but too often all the water of a locality is in swiftly flowing streams, where such an application is not effective.

The method of applying some oily or ill-smelling substance to stock for the purpose of repelling the flies has been in use for a long time, but the main objection to it is that a single application does not last long enough. Kerosene emulsion,* diluted with two parts of water, with the addition of a little carbolic acid, has received favor in some sections. This may be applied with an atomizer or hand sprayer. A small atomizer that will throw a very fine spray may be had from different manufacturers and dealers for about a dollar, and with such a device one can go over an ordinary-sized herd of cows in a few minutes.

Several prepared mixtures are on the markets, and Mr. S. J. Baldwin recommended the following in the Ohio Farmer for August, 1904: Kerosene, 3 gallons; pine tar, 1 quart; carbolic acid, 1 pint. These may be applied in the same way as the above.

All of these mixtures, when properly applied, kill many of the common flies,** such as the horn-fly and others which usually cling to the animal until the application is made. The horseflies, however, will not remain long where the atomizer is in operation, consequently the repelling properties of these substances are practically all that are effective.

When in Louisiana in 1903 my attention was attracted by the large number of horseflies that entered the Station

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*Kerosene emulsion can be made from 2 pounds of whole oil (or good laundry) soap, 4 gallons of water and 8 gallons of kerosene, as follows: Weigh the soap carefully and place with the water in a vessel over the fire, using a slight excess of water to make up for evaporation. Fit a pump with a straight piece of hose, to which is attached a nozzle for throwing a straight stream 3-16 or 1-4 inch in diameter. Pour the oil into a barrel or tub in which the pump is set, and when the soap is dissolved and the solution begins to boil, add it to the oil *(away from the fire)* and pump the whole vigorously back into itself for a period of at least ten minutes. The stream from the nozzle should be directed straight downward into the mixture so as to agitate it to the very bottom. After a few minutes the oil and soap solution will be seen to combine, forming a thick creamy solution which, when perfectly made, will remain without change for several days. For a 20 per cent. strength add water to make a total of 40 gallons; for a 15 per cent. strength add water to make 54 gallons, and for a 10 per cent. strength add water to make 80 gallons, and agitate thoroughly before use.

**Of the Family Muscidae.

building at Cameron when the screens were left open at the time of day when they were flying; and Mr. M. W. McCall stated he had noticed the same thing in previous years. The three species common at Cameron are *Tabanus lineola* (lined horsefly), *T. 5-maculatus,* and *T. costalis* (green-head horsefly), and are the ones upon which my observations were made. The Station building is much the largest building in the locality, is constructed in the form of a cross and is painted a clear white. I have never fully satisfied myself as to the reason for this strange behavior of the flies, for there may be two or three reasons for it. They may be attracted by the white color of the building, or by the shade which it affords, or they may possibly enter it through a desire to secure protection from their enemies. The flies that entered a doorway, about 5x7 feet, in five hours' time, on August 23, when killed nearly filled a quart measure, and almost all of them were females. This observation suggested that a trap might be constructed that would accomplish similar results, and accordingly, in 1905, the trap was built, but by the time it was ready the horseflies were almost gone and did not appear in sufficient numbers again while I was in that locality to give me an opportunity to observe its workings.

While preparing a paper on the Tabanidæ of Ohio, it was suggested that, since many horseflies lay their eggs over water, and also since the larvæ from these eggs must drop into the water when they hatch, kerosene on the surface of the water might be used to kill these immature forms, and a measure of success was obtained when the oil was used on stagnant ponds.

Since, as shown above, various species are very uniform in placing their eggs, there may be times when a systematic gathering of these will give practical results. It is often possible to find places where as many as 60,000 may be gathered in a single hour. This would be practical, if at all, in a country where there is only once in a great while a place for these flies to oviposit.

THE SPECIES OF HORSEFLIES KNOWN TO OCCUR IN LOUISIANA.

Most of the species of horseflies thus far taken in the State were collected by Mr. Newell and his assistants, Messrs. Hardy, Garrett, Martin and Flynn, during the summer of 1905. Some, however, were taken in former years by Prof. E. L. Moseley, of Sandusky, Ohio, who has a plantation in West Carroll Parish, and a number of specimens have been received from Mr. Charles W. Johnson, of the Boston Society of Natural History. The writer has also collected in the southwestern part of the State in two different seasons. As stated, the species taken belong to two genera, *Chrysops* and *Tabanus*. The first includes the small flies commonly called earflies, woodflies or similar names, while the latter includes the others, all of which are larger in size The horseflies proper belong to the genus *Tabanus*, and are readily distinguished from the species of *Chrysops* on account of larger size and the absence of small spines at the end of the posterior tibiæ.

CHRYSOPS FLAVIDUS Wiedemann (Brown Earfly). This is perhaps the most common member of this genus on the Louisiana gulf coast, and it has frequently been taken in other parts of the State. The species is almost uniformly brownish all over, but some irregular dark markings are present on the abdomen, and there are four narrow gray stripes on the thorax. The two sexes are much alike, except that in the male the brown markings of the wing are more extensive. The wing in both sexes is brown and subhyaline.

The following observations made by Mr. Newell serve to give an idea of the importance of this fly:

"At Cameron, on June 9, 1905, I found a number of specimens inside the slat-work around the cistern at the Gulf Biologic Station. This was about 5 o'clock in the evening. A few were also found on the walls of the Station building and on the outside of the window screens. About twenty specimens were caught. Just after sundown I went out through the long grass to the beach, and while in the grass plat was attacked by at least a dozen specimens. They do not buzz around preliminary to biting, but sail right in like a hornet, and bite as soon as they alight. They show no fear when making an attack and can be caught easily when they have once alighted on clothing or flesh. The bite is painful, often followed by a slight swelling and a severe itching. During the middle of the day they are shy and somewhat hard to capture. Specimens occasionally attacked one for some time after sundown, both around the laboratory and near the hotel. Mr. Martin, who was collecting in the marsh east of the laboratory at sunset, the same day, was also severely bitten by them.

On the morning of June 10, I found but one or two individuals inside the lattice work surrounding the cisterns, where a couple of dozen were taken the afternoon previous. About a dozen were seen on the walls of the Station building. Prof. Guilbeau, who has spent three summers at the Station, had never observed this species so abundant as at the present time. Both Messrs. Cary and McCall say that this fly had not been annoying the present season until their appearance in numbers on June 9. In fact, they had not been noticed at all, but this may have been due, in part, to their not having attacked people so viciously prior to this time. Evidently the adults were appearing in greatest numbers, or else were daily becoming more abundant. On the afternoon of the 10th, about 4 o'clock, I was attacked by three or four specimens while near a muddy pond east of the Station. About 2 o'clock I thoroughly swept over the grass lot where the flies were so abundant the evening before, thinking that possibly they spent the day hiding in the grass. Not a single specimen was obtained, but since the grass was very high, the flies might not have been caught if they had been present and near the ground.

On June 11, we were occasionally attacked by one or two flies at different times during the day, especially when near brush or timber, and this made it appear that they sought sheltered places during the middle of the day. On the following day we were again attacked by several specimens while collecting in a cotton field about 9 o'clock in the morning. The species did not appear, on this date, to be as abundant as on the 9th."

CHRYSOPS OBSOLETUS Wiedemann. This species has a wide range and is often abundant. It is usually encountered along the edge of woods where the females are annoying pests. The color of the fly is black, with the wings partially hyaline and with usually a yellow stripe on the middle of the abdomen, although there may be variation in the color of this last. Specimens were taken by Newell at Foresthill, on September 8. It usually occurs earlier in the season than this.

CHRYSOPS PIKEI Whitney (Little Earfly). This is a rather small species, about the size of the common house fly. It was recently described from specimens taken in Pike County, Missouri. The thorax is black, with four narrow yellow stripes; the abdomen may be described as yellow, with four black stripes, but the one on each side disappears on the first two segments. Judging from the number of specimens taken during the latter part of August and the first part of September, the species must be very common. They were taken in other months also. Following are some of the records of capture: Many, May 19 (Newell); Montgomery, June 29; Gloster, July 14; Frierson, July 14; Keachie, August 23; Logansport, September 6 (Garrett); Foresthill, September 8 (Newell).

The following observations on this fly were made by Mr. Garrett:

"These insects were numerous and very annoying in the vicinity of Logansport. They almost invariably attacked horses' ears and very frequently left them covered with blood. They were most numerous near creeks and bayous, but were found to some extent in higher places."

CHRYSOPS VITTATUS Wiedemann (Striped Earfly). This is a common species all over the eastern United States, and was taken in many localities in Louisiana the past summer. It is usually larger than the last two species mentioned above, but is about the same size as *C. flavidus.* In general appearance it is more yellowish than most species of its genus; the stripes on the thorax are bright yellow and conspicuous; the black stripes on the abdomen are narrow and composed of a series of elongated spots joined end to end. The following records indicate its general distribution and time of appearance: Montgomery, June 29; Gloster, July 14; Lecompte, June 8 (Hardy); Logansport, September 8 (Garrett); Foresthill, September 8 (Newell).

The following observations upon its habits were made by Mr. Newell:

"During several days of traveling through southwestern Rapides Parish, between Lecompte, Woodworth, Foresthill and Glenmora, I encountered this species wherever low or swampy valleys were crossed, especially where the growth of underbrush was dense. The flies attacked the necks and ears of the horses, both being often covered with blood from their vicious bites. In a swampy area on "Spring Creek," southeast of Glenmora, I counted as many as twenty-five on the ears of my horse at one time. This species was not found in the long-leaf pine timber, but only in the creek bottoms running through the 'piney woods' country. This fly evidently does not attack man, as at different times I approached large numbers of them flying about the horses' heads, for the purpose of capturing specimens, but was not once bitten. After a few individuals were captured the rest usually became alarmed and flew away. The individuals which were engorging themselves with blood, on the other hand, showed no fear and stuck so tenaciously to the animals that it was almost impossible to remove them without injuring them as specimens."

TABANUS ATRATUS Fabricius (Black Horsefly). This large black horsefly is generally distributed over the eastern United States, and as far west as Colorado. It is entirely black, wings and all, and on this account it is easily recognized. This species has been taken during the past summer as follows: Logansport, June 25; Negreet, May 19; Cameron; August 23; New Orleans, August 29. A discussion of this species and its habits was given on a previous page.

TABANUS AMERICANUS Forster (American Horsefly). This is our largest North American species. It is restricted in its distribution to the southeastern United States. The color is red, the wings are hyaline with a narrow front border which is pure brown. Its bite is severe, but the species does not usually appear in numbers sufficient to make it as serious a pest as some of the smaller species. Specimens were taken at Montgomery, June 29.

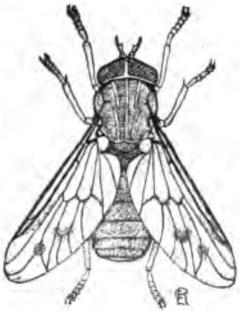

FIG. 17.—Brown horsefly *(Tabanus benedictus)*, female, natural size.

TABANUS BENEDICTUS Whitney (Brown Horsefly). This species was but recently described from specimens taken in Missouri. It is a large species, about the size of *T. atratus*, which it resembles somewhat, but the body is dark-brown and the wings are subhyaline. It does not appear to be as abundant as some of the other species, but has been reported as injurious to driving-horses. Taken at Crowley, June 17; Montgomery, June 29; Frierson, July 14.

TABANUS SULCIFRONS Macquart (Autumn Horsefly). This is somewhat smaller in size than the species of *Tabanus* named above. The thorax is marked with narrow gray stripes, the abdomen is reddish above, with a median longitudinal row of white triangles, and the wings are subhyaline with a number of small brown spots. It is distributed generally over eastern North America and is one of the most abundant and annoying pests of the Family Tabanidae. It is one of the late-appearing species, being abundant when many other species have nearly disappeared. Specimens were taken at Lecompte, September 7 (Newell); Logansport, September 6; Keachie, October 16 (Garrett).

Mr. Newell made the following observations upon the habits of this fly:

"In driving through the 'piney woods' country (uplands), west of Lecompte, from the 1st to the 7th of September, I found this species fairly abundant. From three to fifteen were constantly following the team while in the pine uplands and many were captured. They would frequently fly into the buggy and alight on the underside of the top. Along creek bottoms and in swamps they were not nearly so abundant as in the uplands, occurring only occasionally. In addition to their attacking horses, I noticed them on mules, cows, sheep, and in one case attacking a cat. They did not bite persons, although they were offered many opportunities. They were rather shy and difficult to capture. When we were attempting to catch individuals around the team, frequently all of them would leave to return again as soon as the collector moved away a few feet. I noticed that this species, when flying over water, would frequently drop to the surface, and after striking it with the body, quickly dart away again."

Mr. Garrett reports that this species was abundant at Keachie from July all through September and October, and that it was practically the only species of *Tabanus* found in that locality during the two latter months. During the entire time that it was abundant Mr. Garrett noticed that the flies entered a farm house in that locality in considerable numbers and collected upon the screens inside of the house, similar to the manner in which the Tabanids did in the laboratory at Cameron. Large numbers of them had died of starvation and had collected in masses upon the window sills and entirely filled the space between the window sill and screens.

TABANUS MEGERLEI Wiedemann. This species has the eyes pilose and is the only one of its group thus far taken in the State. The thorax is dark colored, but with indications of gray stripes; the abdomen is reddish with a wide black stripe down the middle; the wing is blackish at the base, but the apical half is mostly hyaline, with a black dot on the cross-vein and at the forking of the third vein The species usually appears early in the season and the single specimen taken in Louisiana is no exception. It was taken on the Experiment Station farm at Calhoun, April 7, from mules in the field (Newell). Previous records indicate that this species was known from Florida only.

TABANUS VENUSTUS Osten Sacken (Spotted Horsefly). This is one of the most distinct species of its genus found in the State, and there is no other fly that can be confused with it. The thorax is plainly striped with gray; the abdomen is black, with a middle row of distinct white triangles. The wings are variegated with hyaline and black, the two being nearly equally divided. The coloration of the wings readily distinguishes the species. Taken at Logansport, August 19 (Garrett).

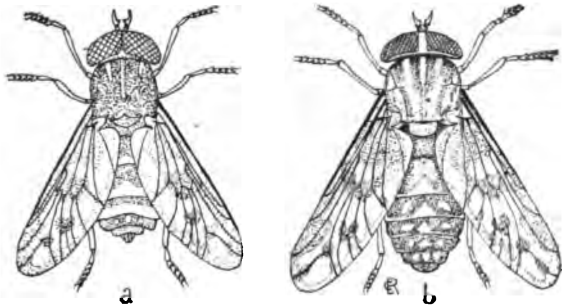

FIG. 18.—Spotted horsefly (*Tabanus venustus*): *a*, male; *b*, female; enlarged two diameters.

Mr. Garrett says this species seemed to be very scarce in the vicinity of Logansport, for special attention had been given to all horseflies noticed while traveling through the country, and only four specimens of this particular species had been captured. Three of these were captured at the same place, in the edge of an old field grown up with young pine trees. Two of the three were captured on August 19 and the other one on September 6. The fourth was captured near Mansfield on September 9.

This species was previously known from Texas, Kansas, Oklahoma and Ohio. It appears to be abundant in parts of Kansas and is said to be a pest of considerable consequence.

TABANUS COSTALIS Wiedemann (Green-head Horsefly). Thorax yellowish, without stripes; wings hyaline with the front border yellow or brown; abdomen with a distinct median stripe and a stripe, more or less distinct, on either side. Length, slightly more than half an inch. In addition to its occurrence at Cameron, mentioned below, it was taken at Robeline, May 25 (Garrett); Lake Charles, June 13 (Martin); Keachie, June 14 (Garrett); Crowley, June 17 (Martin).

TABANUS 5-VITTATUS Wiedemann. Thorax yellowish with indications of stripes; wings hyaline with brown veins; abdomen usually with three grayish stripes separated by brown stripes of nearly the same width. Average length about two-thirds of an inch.

TABANUS LINEOLA Fabricius (Lined Horsefly). Thorax more brownish than yellowish, showing three narrow whitish lines, which are more distinct anteriorly; wings hyaline with brown veins; abdomen with a distinct median gray stripe, and on each side an irregular gray stripe formed of elongate oblique spots. Same size as *T. costalis*.

The three species just named are the common ones at Cameron, where the Gulf Biologic Station is located. Probably the first is the most important from an economic standpoint, for it is very persistent in its attacks upon stock. It habitually alights on the under parts of animals, where they have difficulty in reaching it, and it is therefore almost sure to satisfy its appetite before leaving. However, all three of these species are important stock pests. They fly at the same time and in the same places and are often mistaken for one and the same insect. They flew around the laboratory building in great numbers and could be seen resting on the siding and windows at almost any time during the day. If the screens were allowed to stand open they entered the building in numbers and eventually collected on the windows, where they died of starvation.

The three species just considered all have stripes on each side of the abdomen, while the three following species have rows of rounded spots on each side of the abdomen.

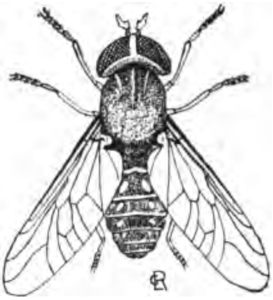

FIG. 19.—Little horsefly *(Tabanus pumilus)*, female, enlarged to three diameters.

TABANUS PUMILUS Macquart (Little Horsefly). This is one of the smallest species of its genus, being only about one-third of an inch in length. Thorax black, with narrow gray stripes. Narrow gray posterior border of each abdominal segment expanded into a very small triangle at the middle; thus the abdomen has a median row of small gray triangles, and on either side of this a row of small gray spots. Wings hyaline. One specimen taken at Leesville, April 28, 1905 (Newell). This species is also distributed over the eastern United States.

TABANUS SAGAX Osten Sacken. Femora blackish; thorax uniformly yellowish, without stripes; wings narrowly yellowish on the anterior margin, otherwise hyaline; abdomen with a rather prominent median dorsal band and a row of rounded spots on either side. One-half inch in length, some specimens larger. This species has been taken at several places in the eastern United States. Captured in Louisiana at the following places: Shreveport, June 14 (Newell); Frierson, July 14; Logansport, September 6 (Garrett).

"On June 14, 1905, while coming into Shreveport on the Kansas City Southern Railway, and while standing on the rear platform of the last car, I noticed two of these insects following the train, and occasionally alighting upon the coach. The train was running about twelve miles an hour and was a few miles out of Shreveport. I succeeded in capturing but one of the two specimens." (Newell).

Mr. Garrett made the following note at Logansport on September 6: "These flies usually attack the horses' legs and are quite annoying, for when they have once settled the horse can hardly get rid of them. They are quite numerous at this date."

Again: "These little insects were taken from the legs of horses which were being driven to a buggy. They usually alight on the horse's leg between the hock and the hoof, and are rather difficult for the horse to drive off, which he usually tries to do by stamping or kicking."

TABANUS FULVULUS Wiedemann. Length, three-fifths of an inch. Some specimens are larger and some are smaller. Thorax without stripes; wings with the anterior margin narrowly yellowish, but otherwise hyaline; abdomen with a median dorsal band and a row of spots on each side, whitish or yellowish. It differs from *T. sagax* by having the femora yellowish instead of blackish, and the third segment of the antenna is not so plainly angulated above as in that species. It is known from Kentucky, Maryland, North Carolina and New Jersey, and appears to be common near the seacoast. Taken from a horse that was being driven to a buggy, June 17, 1905, near Crowley, in the southern part of Louisiana (Martin).

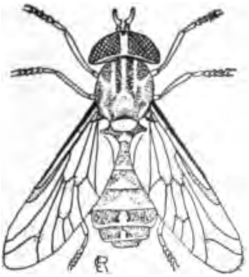

FIG. 20.—Say's horsefly *(Tabanus molestus)*, female, enlarged to one and a half diameters.

TABANUS MOLESTUS Say (Say's Horsefly). The thorax is dark-brown, plainly striped with gray; the abdomen is black, with the posterior margin of each segment narrowly gray, expanding into a prominent triangle at the middle of the third, fourth and fifth segments. There is also a small triangle on the second segment, but it is so small in comparison with those on the following segments that it is hardly noticeable. Wings subhyaline, veins brown, but not margined

so as to form distinct brown spots. The species is widely distributed over the southeastern United States. In Louisiana it has been taken as follows: Negreet, May 19; Leesville, June 2 (Hardy); Merryville, June 2 (Martin); Houghton, June 20, 1905 (Garrett). So far as observed the adults occur in the early part of the season only. The larger specimens are seven-eighths of an inch in length, but the Louisiana specimens I have seen are somewhat smaller.

CONCLUSIONS.

Since there is a great deal yet to learn about horseflies, it seems proper to call attention to a few points worthy of special consideration.

Predacious and parasitic insects which prey upon horseflies are capable of doing much towards checking the ravages of certain species. Who knows but what these natural enemies of the flies could accomplish much more if conditions were more to their liking? The work of the horse guard *(Monedula carolina)* is especially efficient, and since it appears that this species thrives in certain sections where there is sand for it to make its nests in, could it not be introduced into places where it is not known at the present time? If more were known of its habits and requirements, life history and enemies, it might be possible to increase its numbers in sections where it is now present but not plentiful enough to do the work desired of it.

Before it is possible to speak intelligently concerning what may be accomplished in the way of combatting any injurious insect or group of insects, a full knowledge of each species is usually necessary. The codling moth of the apple could not be handled successfully until a careful study of its life history showed that the young insect entered the calyx end of the apple in the spring, and that if this part of the apple were thoroughly sprayed with the proper mixture before entrance was effected, it would receive a fatal meal the first thing; but that if spraying were deferred until after it entered, the insect could not be reached.

Not over a dozen of the North American horseflies are known in their immature stages, the eggs of less than ten species have been described, and the larvæ of some of the most abundant and injurious forms remain unknown. When we consider that the first larva of an American horsefly was described more than thirty years ago, and that since that time many economic entomologists in all parts of the country have been investigating all manner of subjects with which insects are concerned, we hardly know how to explain the fact that so little is really known about these stages.

If all species were alike in their habits, a knowledge of the immature stages of one species would make it an easy matter to work out the life histories of the others. The fact that so few have been worked out is proof in itself that all species are not alike; and when one undertakes the study of a particular species, in addition to those with which he already claims an acquaintance, he is not only convinced that the immature stages of two species may be different, but that they may have scarcely a single habit in common.

Horseflies are a recognized pest in all parts of the world, and although it is difficult to estimate the damage done by them, every farmer and stock-raiser admits it to be considerable. It is a fact that all remedies that have been suggested are unsatisfactory in a measure, but it is quite possible that by continued study and investigation of the problem effective remedial measures may be developed.

The State Crop Pest Commission of Louisiana

Was established by the Extra Session of the Louisiana Legislature of 1903, by Act No. 6, Approved December 15th, 1903, for the purpose of promulgating and enforcing Rules and Regulations intended to prevent the introduction and dissemination of insects and diseases inimical to the crops and fruits of the state; to investigate seriously injurious insects or diseases occurring within the State, to devise ways and means for their control or eradication and to publish bulletins and in other ways disseminate information regarding the insects and diseases injurious to fruits, crops, etc.

The Circulars of the Commission are issued from time to time as the result of the investigations being made and whenever such publication is deemed advisable in order to place reliable information in the hands of planters, fruit-growers and farmers regarding certain injurious insects or diseases. These Circulars are sent free of charge to all farmers and fruit-growers in the State who make application therefor. Applications for these Circulars, as well as for copies of the Regulations of the Crop Pest Commission, or of the Act No. 6 establishing the Commission, when these latter are desired, should be made to the Secretary of the Commission (Baton Rouge, La.).

Circular No. 3, November, 1905, contains a discussion of the cultural remedies to be used against the boll weevil and should be secured by every cotton planter and farmer in the State of Louisiana.

Circular No. 4, December, 1905, describes the San Jose scale, a serious insect enemy of fruit trees, and gives the means by which it may be controlled. All fruit-growers should write to the Secretary of the Commission for a copy.

Circular No. 5, January, 1906, contains a general discussion of the boll weevil situation, and the lines along which Louisiana's campaign against this insect is being conducted.

CIRCULAR NO. 7

OF THE

STATE
CROP PEST COMMISSION
OF
LOUISIANA

FIRST BIENNIAL REPORT OF THE SECRETARY

FOR THE YEARS

1904 and 1905.

TO THE GOVERNOR

Issued Under the Direction of the State Board of Agriculture and Immigration.
CHAS. SCHULER, Commissioner.

BATON ROUGE:
THE TIMES, OFFICIAL JOURNAL OF LOUISIANA
1906.

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State Crop Pest Commission of Louisiana.

ORGANIZATION.

Hon. Newton C. Blanchard, Governor of Louisiana, Baton Rouge.

Hon. Chas. Schuler, Commissioner of Agriculture, Baton Rouge.

Prof. W. R. Dodson, Director of the Louisiana Agricultural Experiment Stations, Baton Rouge.

Hon. L. S. Frierson .... Frierson

Hon. B. W. Marston .... Eastpoint

Wilmon Newell, Entomologist of the Louisiana Agricultural Experiment Stations; Secretary and Entomologist of the Commission, Baton Rouge.

J. B. Garrett,
C. W. Flynn,
E. C. Cotton,
Harper Dean, Jr.
} Assistant Entomologists and Inspectors, Baton Rouge.

Miss L. E. Renneker, Clerk and Accountant, Baton Rouge.

LETTER OF SUBMITTAL.

To His Excellency, Newton C. Blanchard, Governor of Louisiana:

SIR:—I have the honor to submit herewith, a report upon the work of the State Crop Pest Commission, established by Act No. 6, of the Extra Session of 1903, for the years 1904 and 1905; together with a statement of the results obtained by the enforcement of quarantine regulations preventing the artificial dissemination of the boll weevil and the San Jose scale; the results secured in the investigation of entomological problems of immediate importance to the agriculture of the State, and an outline of the work at present under way and contemplated for the coming year.

Very respectfully,
WILMON NEWELL,
Secretary.

Baton Rouge, La., February 15, 1906.

State Crop Pest Commission
OF LOUISIANA.

CIRCULAR No. 7. March, 1906.

The Circulars of the State Crop Pest Commission are sent free of charge to all farmers and fruit growers of Louisiana who make application therefor.

FIRST BIENNIAL REPORT OF THE SECRETARY FOR THE YEARS 1904 AND 1905.

TO THE GOVERNOR.

Baton Rouge, La., February 15, 1906.

The discovery, in July, 1903, of the boll weevil in a cotton patch upon the grounds of the Audubon Park Experiment Station, at New Orleans, forcibly attracted the attention of the entire State to a new danger which threatened the future success of her most important crop.

The Special Session of the Legislature which convened in December, 1903, passed an Act establishing the State Crop Pest Commission, to consist of the Governor of the State, the Commissioner of Agriculture, the Director of the Louisiana State University Experiment Stations, two practical cotton planters and the Entomologist of the State Experiment Stations. The Act creating this Commission wisely vested in it the power of making and enforcing quarantine regulations to prevent the introduction and dissemination of dangerous insects and diseases of crops and fruits, and to investigate and devise remedies for such.

This law has proved to be, undoubtedly, the most conservative, yet far-reaching, practical and effective law for the control of crop pests and diseases that has ever been adopted in any state or country.

Following the approval of this Act, the Commission organized and held its first meeting at Baton Rouge on February 5, 1904.

At this meeting Prof. H. A. Morgan, Entomologist of the State Experiment Stations, was elected Secretary of the Commission, and quarantine regulations looking to a prevention of the further progress of the boll weevil into Louisiana territory were adopted and at once placed in effect.

1904

The work of the Commission during 1904 was entirely under the direction of Prof. H. A. Morgan.

At the beginning of the year the only territory in Louisiana known to be infested by the boll weevil was in western Sabine Parish. This infestation the Commission exterminated by inducing the farmers in the affected territory to abstain from the planting of cotton during 1904, the planters and farmers being paid a cash rental for the acreage thus "thrown out" of cotton during that season.

An infestation discovered near Logansport in July, 1904, was also exterminated. More particular references to these are made in Circular No. 5 of the Commission, copy of which is submitted herewith.

In August, 1904, Prof. Morgan discovered that the boll weevil, in addition to being disseminated artificially in hulls, cotton seed, etc., possesses a migratory habit, which manifests itself during late summer and autumn. This migration of the weevils, during the summer and autumn months of 1904, carried the infestation again into the territory where the pest had been exterminated, and, in addition, gained for it about twenty miles to the eastward. The discovery of this habit of the insect entirely revolutionized the methods to be employed in limiting the weevils' progress, and the quarantine regulations, which had previously been enforced to the extent of causing serious inconvenience to business interests, were supplanted by regulations fully as effective in preventing the artificial spread of the weevil and entailing no loss to individuals or business interests.

These regulations have, up to the present time, been entirely effective in preventing the weevil from obtaining a foothold in Eastern and Northeastern Louisiana. Had it not been for the enforcement of these regulations there can be but little doubt that there would now be many local centers of infestation in the area (four-fifths of the State) still free from this pest.

During the summer and autumn months of 1904, the entomologists of the Commission, in co-operation with the Special Field Agents of the Bureau of Entomology, United States Department of Agriculture, made numerous field examinations in studying the previously unknown migratory habit of the weevil, in determining the territory infested, in investigating the results obtained by planters in the use of Paris green against the boll weevil, and in disseminating information among planters and farmers in the infested territory.

1905

Following the resignation of Prof. H. A. Morgan, in February, to accept the Directorship of the Tennessee Agricultural Experiment Station, the writer was elected to succeed him as Entomologist and Secretary of the Commission.

Early in the year plans were made for field demonstrations in the growing of cotton by the cultural system in the weevil-infested sections, for studying closely the migratory habits of the weevil, for testing Paris green and other substances as remedial agents against the weevil, as well as for investigations of insects injurious to crops other than cotton. All of this work required the almost constant movement of the Entomologist and his assistants from one neighborhood to another and from plantation to plantation. The yellow fever quarantines during August, September and early October made the continuation of this work impossible. Although attempts were made to continue the field work in spite of the quarantines, it was soon found that this incurred the marked displeasure of citizens in the localities visited, and field work, accordingly, had to cease. This "break" of over two months in the field observations and experiments severely crippled the work of the Commission, and a number of experiments which were being conducted with promise of giving valuable results had to be abandoned. However, in spite of the obstacles encountered, the Secretary feels that the results obtained in the field and experimental work have amply justified the expense, and that the amounts thus invested will be repaid many fold in the decreased insect damage to various crops, made possible by the application of the information gained in this work. Particular mention of the different lines of work conducted and matters of interest follow.

CO-OPERATION WITH THE BUREAU OF ENTOMOLOGY.

In view of the fact that the retardation of the boll weevil's progress eastward is of vital importance to the entire cotton-growing area of the country, the United States Department of Agriculture, Bureau of Entomology, early in 1904 very generously offered to co-operate with the State Crop Pest Commission in the boll weevil investigation, demonstration work, etc. This co-operation has continued through both 1904 and 1905, the utmost harmony prevailing between the employees of the Bureau and of the Commission. The Secretary of the Commission has been freely granted the advice and counsel of both Dr. L O. Howard and Prof. W. D. Hunter, and, in addition, the Bureau has contributed very materially to the expense of the work in Louisiana by paying the salaries and traveling expenses of a part of the Commission's working force. In its co-operative work with the Commission during 1904, the Bureau expended $7,884.03, and during 1905, $3,959.90. This has meant, of course, a corresponding saving of the funds appropriated by the last Legislature for the work of the Commission. No plans have as yet been made for co-operative work with the Bureau of Entomology during the coming fiscal year, such co-operation being dependent upon congressional appropriations and upon the pleasure of the Honorable Secretary of Agriculture. Without the co-operation of the Bureau this year, the expenses of the Commission will be correspondingly increased.

BOLL WEEVIL QUARANTINE.

As referred to above, and as pointed out in Circular No. 5 of the Commission, the extermination of isolated sporadic outbreaks of the boll weevil, when these outbreaks occur (as did the Audubon Park outbreak of 1903) outside the area of yearly migrations, is both possible and practical, and during 1905 the Commission has held itself in readiness to promptly suppress and exterminate any outbreak which might occur in Eastern or Northern Louisiana.

The Commission has received the hearty co-operation of the farmers in the non-infested territory, and numerous reports of the weevil occurring in this territory have reached the Commission. All such reports were investigated, usually by personal visits to the localities and by actual examination of the cotton fields supposed to be threatened by the pest. In all cases the reports were found to have been occasioned by other insects. As not a single case of infestation has been found in the eastern portions of the State, the quarantines maintained by the Commission may safely be assumed to have saved those sections many thousands of dollars on the cotton crops of the next few years.

As the cotton-growing section of the State east of the Mississippi River is not likely to suffer severe weevil damage within the next three or four years, and as Northeastern Louisiana will not be reached by the weevil in its natural spread for six or eight years, the advisability of protecting those sections from artificial or accidental introduction of the boll weevil in the meantime, by regulations such as have already proven effective, must be self-evident.

The boll weevil quarantines maintained by the Commission, and their operation, are discussed in Circular No. 5, copy of which is attached.

CULTURAL EXPERIMENTS AND DEMONSTRATIONS.

The excessive rains of early summer resulted in the overflow of several experimental plats of much importance, and during midsummer the quarantines prevented the assistant entomologists from giving personal attention to the field experiments, so that the results were by no means as satisfactory as had been expected. They did demonstrate, however, the material increase in cotton production in boll weevil sections, made possible by the use of early-maturing varieties of cotton, proper use of fertilizers and thorough cultivation.

In the spring of 1905 the Commission distributed King cotton seed to a number of farmers in Sabine Parish, and in December obtained from these same farmers their cotton acreage and production. For comparison, similar data were obtained from other farmers who did not use early varieties or attempt to follow the "cultural methods." These records show that those farmers who followed, essentially, the cultural measures urged by the Commission, made upwards of 90 per cent more cotton per acre than did those farmers in the same locality who used "native" seed and adhered to their former plan of planting a larger acreage than could be properly cared for with the labor at their command. This success, on the part of individual farmers, in applying the cultural methods, with a resultant increased production of over 90 per cent, is most encouraging. By continuing an active educational campaign among the planters and farmers and by continued field demonstrations the Commission can undoubtedly bring about the general adoption of the cultural remedy, with a resultant saving of at least as large a per cent of the crop as that saved by the farmers of Sabine Parish referred to.

The cotton crop of the parishes in which the boll weevil at present occurs (Bossier, Caddo, Calcasieu, Cameron, De Soto, Grant, Natchitoches, Rapides, Red River, Sabine, St. Landry, Vernon and Winn) during the years 1899 to 1903, inclusive, averaged 263,565 bales per year, which at $50.00 per bale may be considered as worth in the neighborhood of $13,178,000. Assuming that, without the adoption of the cultural remedy, the boll weevil will reduce this yearly crop but 50 per cent (and it is likely that the reduction, under such circumstances, would be much greater than this), the annual crop of this territory will be reduced to 131,000 bales. The farmers in these parishes can apply the cultural remedy with at least as good results as did the Sabine Parish farmers mentioned above, and the general adoption of the cultural remedy in these parishes will therefore result in a *saving* of *at least* an amount equivalent to 90 per cent of the 131,000 bales, or 118,000 bales per year, worth in the neighborhood of $5,900,000.

Perhaps the greatest obstacle with which the Commission has to contend, is the prejudice which some farmers have towards "scientific" work and methods. Failing to realize that true science is nothing but the plain unvarnished *truth*, they attempt to disparage what they are pleased to call "book-farming." This unfortunate obstacle to a universally successful campaign against the boll weevil can, and must be, overcome, by educational work, as carried out by the Commission in a liberal distribution of literature, in addresses before agricultural meetings, and in actually demonstrating in the field that cotton can be profitably grown in spite of the boll weevil.

EXPERIMENTS WITH PARIS GREEN.

Early in the season plans were made for conducting thorough tests of Paris green as a remedial agent against the boll weevil. These experiments were made in large cages constructed for the purpose near Keachie, La., and also in the open field. The application of the poison, as well as amounts, dates of applications, etc., was directed by Hon. B. W. Marston, a member of the Commission, and the observations upon effectiveness, as well as the records of production of the different plats in the experiments, were made by Mr. J. B. Garrett, Assistant Entomologist. Mr. Garrett's results in connection with the cage experiment were afterwards verified by a committee of prominent cotton planters who visited the experimental cages and made a searching investigation of the experiment.

In the vicinity of Keachie the weevils did not emerge from hibernation until after the young cotton had commenced putting on squares, and therefore no opportunity was had of testing the effectiveness of the poison when applied prior to the time of squaring. Applications of Paris Green, in various amounts, gave results* which showed the use of the poison in late summer, so far as the boll weevil is concerned, to be not only unprofitable, but to actually result in decreased production through injury to the cotton itself.

OTHER EXPERIMENTS.

A number of other investigations in connection with the boll weevil have been made, among which may be mentioned the successful fumigation of cotton seed with hydrocyanic acid gas at a strength that will kill all boll weevils, but which will not impair the germinating power of the seed. This method, while too expensive to employ in a commercial way at present, is being employed in the fumigation of seed of early varieties of cotton from the weevil-infested territory when it is necessary to take this seed to the non-infested sections for experimental or demonstration work. The danger of disseminating the weevil with such seed is thereby eliminated.

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*In the cages, cotton not poisoned and in which the boll weevils were allowed to breed unmolested, produced at the rate of 676 pounds of seed cotton per acre: cotton to which a total of 2 7-8 pounds of Paris green per acre was applied produced at the rate of 525 pounds seed-cotton per acre, while the cotton which received a total of 10 3-4 pounds of poison per acre produced only 406 pounds of seed-cotton per acre.

In the "field experiment," in which Paris green was applied to cotton in the open field, poisoned cotton which received three separate applications of two pounds per acre each, produced 203 pounds of seed-cotton per acre. Unpoisoned cotton, in a field adjoining, produced 565 pounds per acre. All these experiments were upon hill land.

COTTON SEED OIL MILLS.

During the past year the Commission has devised a method by which cotton seed oil mills can handle their hulls, after these leave the huller, in a manner which will effectually prevent the dissemination of boll weevils with them. To oil mills in the infested territory, arranging and screening their shakers and conveyors in the manner required by the Commission, permits are given for the shipment of hulls to the non-infested territory. This arrangement permits an unhampered outlet for the hulls without endangering the localities through which, or to which, the hulls may go.

THE SAN JOSE SCALE.

As mentioned on a previous page, the State Legislature, when enacting the Crop Pest Law of the State, very wisely provided for the control of insect pests other than the boll weevil. Up to the present time the damage by the latter insect, in Louisiana, has not exceeded that done by the San Jose scale, a serious enemy of such fruits as peach, pear, apple, plum, etc. This insect and its destructiveness, the remedies for it, etc., are discussed in Circular No. 4 of the Commission, copy of which is appended.

NURSERY INSPECTION.

Realizing the necessity of preventing additional introduction of the San Jose scale upon shipments of nursery stock from other States, and the necessity of preventing further dissemination of this pest from Louisiana nurseries, the Commission, at its meeting March 15, 1905, adopted regulations requiring the inspection of all Louisiana nurseries at least once a year, the attaching of official certificates of inspection to all shipments of nursery stock coming into the State and the attaching of the Commission's certificate of inspection to all nursery stock sold or shipped by Louisiana nurseries.

The Entomologist and his assistants, during the summer and autumn, inspected all fruit tree nurseries known to exist within the State, twenty-nine in all. Of these, twenty-eight have received certificates allowing sale of the trees and plants grown by them. In the case of thirteen of the twenty-seven nurseries, inspection revealed the presence of San Jose scale either in a portion of the nursery or upon the premises in such position as to endanger the stock being grown for sale. In all cases but one, the owners of these infested premises and nurseries immediately followed the suggestions of the Entomologist for eradicating the pest. The scale was successfully eliminated in the case of twelve nurseries, the owner of the remaining one being too indifferent to the interests of his customers to undertake the eradication of the pest, and he was accordingly refused a certificate.

The twenty-eight nurseries which received certificates, produced healthy, marketable trees and plants as follows:

Peach	248,172
Apple	138,000
Pecan	93,663
Strawberry plants	50,000
Pear	42,000
Field-grown rose bushes	*26,300
Plum	16,619
Orange	15,600
Grapes	8,000
Forest and shade trees	**5,911
Fig	3,300
Privet	1,000

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*Includes only field-grown rosebushes for sale as such, and does not include roses grown in greenhouses or by florists.

**Does not include catalpa trees propagated or grown on catalpa plantations.

Citrus trifoliata	***350
Ferns	****350
Camelias	****175
Magnolias	162
Arbor vitae	100
Palms	****50
Miscellaneous	33,800
Total	683,552

In order that the purchasers of trees and plants may be properly protected against uninspected trees (which are frequently infested with dangerous insects or diseases) the Commission requires a copy of the inspection certificate attached to each shipment and delivery of trees. The twenty-eight nurseries holding certificates have used, in the disposition of the above stock, 27,500 "certificate tags." These tags, having the official certificate of inspection printed upon them, are prepared under the supervision of the Commission in order to guard against fraud, but are furnished to the nurserymen at the actual cost of printing which, for the season, has averaged 18 cents per 100 tags.

In addition to the inspection and supervision of the Louisiana nurseries, the Entomologist and his assistants have made frequent inspections of nursery stock shipped into the State, and have seen that common carriers, as well as nurserymen of other States, comply with the Commission's regulations (copy of which will be found in Circular No. 4).

Shipments coming into the State, found infested with San Jose scale or other seriously injurious insect or disease are promptly confiscated and burned up.

That these measures are conducive to the best interests of the fruit industries of Louisiana is attested by the hearty support and commendation given the work of the Commission along this line, by all the nurserymen and florists of the State, as well as by the State Horticultural Society, fruit growers' associations, etc.

***Does not include trifoliata stocks held by nurserymen for budding purposes.

****Does not include plants of these sorts grown in greenhouses or by florists.

ORCHARD INSPECTION.

At the request of owners, the Entomologist and his assistants have, during the year, inspected twenty-two orchards for San Jose scale and other insect pests. These orchards contained approximately 86,400 trees. In seventeen out of the twenty-four orchards San Jose scale was found, and in one of the orchards the West Indian peach scale was discovered. In all such cases the owners were given directions for bringing these pests under control.

The Commission has not condemned or destroyed any orchard trees on account of infestation by this pest, as it is the aim of the Commission to save property, not to destroy it, and means of fully controlling the San Jose scale economically are available. Where nurseries are infested, however, the imminent danger of the pest being disseminated upon the stock makes destruction of all infested trees and plants absolutely imperative. Not even in the case of infested nurseries has it been necessary to condemn stock, as the owners, with one exception, have been quick to see the damage that would result to their customers if this pest were sent out with their trees, and they have been ever ready to act promptly upon the suggestions of the Entomologist whenever steps for the eradication of the enemy were necessary.

CATTLE TICK INVESTIGATION.

Prof. H. A. Morgan, prior to becoming Entomologist of the Commission, by careful studies of the life-history of the Texas fever cattle tick, devised a successful method of eradicating this destructive pest from farms and plantations. This work was continued by Prof. Morgan during 1904, and his excellent results were presented in Bulletin No. 82 of the State Experiment Stations.

Much remains to be learned concerning the different stages of development of the tick under different conditions and in different localities. This work is being carried on by the Commission in co-operation with the State Experiment Stations. Valuable data has already been obtained, and it is hoped that within a year the Commission will be prepared to undertake the extermination of the tick over considerable areas, in order that stockmen may ship to northern markets and show-rings without experiencing the annoyance occasioned by the present federal quarantine upon cattle from the tick-infested portions of the South.

Tick extermination will mean not only more rapid growth of young animals and the rapid putting on of flesh, but will also mean the complete elimination of Texas or "acclimating" fever.

INVESTIGATION OF HORSEFLIES AND DEERFLIES.

Next to the cattle tick, the horseflies and deerflies have been among the greatest obstacles to profitable live stock production in Louisiana. These pests, by sucking blood from both cattle and horses, very quickly reduce the animals in flesh and make growth and gain in weight impossible during the late summer and autumn months in those localities where abundant.

The horseflies are very closely identified with the spread of anthrax, or charbon, which disease in some years kills many hundreds of animals in the State, and also claims an occasional human being among its victims. In localities where horseflies are numerous, outbreaks of charbon have been invariably followed by a rapid spread of the disease. Dr. W. H. Dalrymple, Veterinarian of the State Experiment Stations, regards the dissemination of charbon by these insects as of equal importance with its dissemination and transmission by the ingestion of infected grasses or foodstuffs. Certain it is, that the occurrence of horseflies in large numbers coincidently with charbon outbreaks, makes the limitation and control of the disease much more difficult than it otherwise would be. The intimate relationship existing between these insects and the spread of charbon but adds emphasis to the importance of devising means by which these pests may be reduced in numbers.

Very few groups of insects present as many difficulties in the determination of life histories as do the horseflies. Most species appear to require in the neighborhood of a year for their growth from egg to adult. The habits of one species and the development of its larvæ may be entirely different from those of all other known species, so that each step in the growth of each species has to be worked out slowly, step by step, before the knowledge necessary for the control of the insect is obtained.

As a preliminary step in attempting to find measures of relief from the damage caused by these insects, the Commission during the year co-operated with the Gulf Biologic Station in a preliminary investigation of the horseflies and deerflies, securing, during the months of June and July, the services of Prof. Jas. S. Hine, a well-known authority upon this group of insects. The work done by Mr. Hine has given us numerous interesting and valuable facts, many of which are given in his report (Circular No. 6 of the Commission). Although several seasons of painstaking study will have to be given these flies before satisfactory means of control will be possible, nevertheless, Mr. Hine's investigation has brought to light the possibility of utilizing some of the natural enemies of this group of insects and the prospects for successfully introducing these natural enemies into sections of the State where they do not now occur, appears very good.

ORANGE INSECTS.

The orange growers of Louisiana have annually lost a considerable per cent of the orange crop through the attacks of orange-infesting insects, of which there are many species, principal among them being the white fly and the purple scale.

In co-operation with the Florida Experiment Station, the Commission is undertaking the introduction into Louisiana orange groves of two fungous diseases which are quite effective in controlling the white fly in the Manatee section of Florida, and which, it is thought, will be particularly effective in the moist atmosphere of our coast sections. While considerable labor and expense is involved in this introduction, it is felt that the chances for the experiment proving successful are amply sufficient to justify making the attempt.

The requests for information regarding methods of controlling orange insects have exceeded, proportionately, the requests for information regarding the insects of any other crop grown in the State, cotton not excepted.

Investigations of the more important orange insects are at present being undertaken by Mr. E. C. Cotton, Assistant Entomologist, and plans are being made for experiments in the fumigation of young citrus trees of various kinds in order that means may be devised for preventing the dissemination of various scale-insects upon young orange and similar trees.

PUBLICATIONS.

In October, 1905, an "Open Letter" to the farmers of Western Louisiana, giving the principal steps included in the cultural remedy for the boll weevil and calling attention to the importance of the fall destruction of cotton plants, was issued in an edition of 10,000 and distributed through the boll weevil infested portion of the State. This publication received most favorable comment, not only from the cotton planters themselves, but also from various cotton interests in Louisiana and adjacent States.

In November, Circular No. 3 was issued in an edition of 10,000 copies. The co-operation of merchants in the smaller towns throughout the boll weevil section was secured in distributing this Circular among the farmers. Before the first edition had been completed by the printer, requests for upwards of 11,000 copies had been received and a second lot of 10,000 was ordered printed. This last edition is already exhausted, and at least 5,000 more copies will be needed within the next few weeks.

In December, Circular No. 4, describing the San Jose scale, and giving means of detecting and controlling it, etc., was issued in an edition of 15,000 copies, and distributed to nurserymen and fruit growers, as well as to the mailing list of the State Experiment Station. A second edition of 5,000 was found necessary, but owing to the universal interest in fruit growing in all sections of the State the demand for this Circular makes necessary a third edition of at least 5,000.

Circular No. 5, January, 1906, entitled, "The Work of the State Crop Pest Commission with the Boll Weevil," has been prepared primarily for the purpose of giving the farmers in the boll weevil section a clear understanding of the nature of the work being done by the Commission, the damage threatened by the boll weevil unless proper measures are adopted, etc., in order that additional co-operation with the Commission may be encouraged. While not giving, directly, any remedial measures for the weevil, it is believed that the plain statement of the situation and the necessity of adopting the cultural remedy, given in this Circular, will go far towards removing the unfortunate prejudice which exists in some sections, towards all scientific and educational progress. This Circular is being distributed in an edition of 32,000, most of these going to the boll weevil infested section for distribution by bankers and merchants.

Circular No. 6, now in course of preparation, gives the results of Mr. Hine's investigation of the horseflies and deerflies in Southern Louisiana, made in co-operation with the Gulf Biologic Station. This Circular is of interest mainly to stockmen, and will be sent to those of our correspondents known to be interested in live stock and to those making application for it. Due notice of its publication and of its contents will be given through the press of the State, so that all who are interested will have an opportunity to secure it.

OFFICE AND LABORATORY WORK.

The compiling of the publications referred to in the above paragraphs, together with preparation of illustrations for them, proof-reading, etc., has required a very considerable amount of time. The mailing of these various publications, requiring the correction of mailing lists, the addressing and stamping of many thousands of envelopes, etc., has been a task the magnitude of which can hardly be appreciated. Much of the time of the assistants during the winter months has been devoted to this distribution of literature, as well as to the compilation of notes and records made in connection with the field work during the summer and autumn.

During 1904, in reply to requests for information regarding injurious insects, in execution of the quarantine regulations, in directing the field work of the assistants, etc., 1651 letters were written. During 1905 the number of letters written was 2,426. These figures do not include circular letters and letters mailed in duplicate to various planters and fruit growers' associations, etc., which were prepared upon the mimeograph, and of which there were several hundred. Many of the letters received require for their intelligent and satisfactory answer considerable study and reference to literature, and it not infrequently happens that letters of from five to fifteen pages have to be written in response to inquiries concerning a single insect, in order that the correspondent may be enabled to combat it successfully, safely and economically.

The writing of these letters, keeping them properly filed and indexed for ready reference, etc., has required the greater part of the time of the clerk and stenographer. The remainder of the clerk's time has been devoted to keeping itemized accounts of all expenditures made by the Commission and its employees and to securing proper receipts and vouchers supporting these expenditures. A very marked and rapid increase in the number of inquiries for information coming to the office is evident, and if this increase continues the employment of an additional stenographer will become necessary.

In the laboratory considerable microscopic and similar work is necessary in the identification of various insects that are sent in by farmers and fruit growers. In order to determine the identity of insects promptly and with certainty, and also to serve in illustrating talks before meetings of horticulturists, planters, etc., a good collection of identified insects is much needed. This the Commission is preparing as rapidly as possible, although the immense amount of routine and office work, together with the work of visiting different localities to make investigations at the request of business men and farmers, has prevented giving this line of work very much attention.

At the November, 1905, meeting of the Commission, the Secretary was instructed to transfer the office of the Commission from Shreveport to Baton Rouge, the latter being a more central location, and, in addition, being the legal domicile of the Commission; and the State Experiment Station, through its Director, Prof. W. R. Dodson, having tendered the use of office and laboratory room in the Experiment Station Building free of rent to the Commission. Had the office remained at Shreveport the coming year, much more office and laboratory room would have been absolutely necessary, requiring the payment of a rather large rental. By the removal of the office to Baton Rouge this money can be utilized in the actual warfare against insects, and will, therefore, be expended to much better advantage than in the payment of rents.

As it has been necessary to continue answering letters of inquiry, distributing literature and attending to some field work besides, the packing and shipping of the various books, specimens, records, office and laboratory apparatus, etc., has required considerable time, and the Baton Rouge quarters have not yet been placed in condition to facilitate rapid work.

During the year a reference library has been started. The publications of various Experiment Stations and of the United States Department of Agriculture have been secured through an exchange of bulletins, and a considerable number of volumes, not available in ordinary libraries, have been purchased outright.

ASSISTANTS AND EMPLOYEES.

As mentioned above, Prof. H. A. Morgan resigned in February, 1905, to accept the directorship of the Tennessee Agricultural Experiment Station, and was succeeded as Secretary and Entomologist by the writer.

During 1904 the following Special Field Agents of the Bureau of Entomology, United States Department of Agriculture, were associated with Prof. Morgan in the boll weevil investigation in Louisiana for the periods named: Mr. R. C. Howell, from May 15 to December 31; Mr. S. E. McClendon, from May 15 to December 31; Mr. J. B. Garrett, from May 15 to October 15; Mr. A. W. Buckner, from May 16 to September 15, and Mr. E. S. Hardy, from May 15 to December 31. Mr. Harry Gustine was employed as office clerk and stenographer from March 15 to December 31. In addition to these gentlemen, local inspectors were employed from time to time during 1904 when their services were necessary.

During 1905, Mr. S. E. McClendon served as Assistant Entomologist from January 1 to February 15; Mr. E. S. Hardy, from February 10 to December 31; Mr. J. B. Garrett, from May 15 to December 31; Mr. W. O. Martin, from May 15 to December 31, and Mr. C. W. Flynn, from June 15 to December 31. The work of all these gentlemen has been performed in a conscientious manner, and their close attention to duty, carrying on their investigations despite many obstacles and frequently undergoing privation and hardship in order to secure valuable information, is to be most highly commended.

Mr. Harry Gustine served as stenographer and office clerk from January 1 to 31, and Mr. J. W. Taylor from May 15 to June 17. Following the resignation of Mr. Taylor, the Executive Committee of the Commission elected Miss L. E. Renneker to succeed him. Miss Renneker has given close attention to her work as stenographer, clerk and accountant, and for her accuracy, interest, and for the immense amount of work done, Miss Renneker is due the thanks of the Commission. Her familiarity with the office work has made possible much field work and investigation by the Entomologist himself which, owing to the amount of correspondence and routine office work, would have been impossible with a less competent clerk in this position.

As Mr. E. S. Hardy tendered his resignation in January, 1906, on account of business interests demanding his attention, the Executive Committee elected Mr. E. C. Cotton, of Columbus, Ohio, to succeed him as Assistant Entomologist. Mr. Cotton entered upon his duties February 2, 1906.

During 1905 the employment of local inspectors was not found necessary.

GENERAL CONSIDERATIONS.

Reference has been made in the foregoing to the direct financial benefit which will accrue to the cotton-growers in the weevil-infested sections if the cultural remedy for the boll weevil is generally adopted. The Commission, by continuing its work along the lines already laid down, can unquestionably bring about the adoption of the cultural methods, and this of itself will repay, in increased cotton production in the boll weevil sections, many times the amount which the Commission will find necessary to expend in this work.

The advent of the boll weevil makes the production of crops other than cotton of much more importance, relatively, than in the past. There is no crop produced which is not subject to more or less damage by insect pests, this damage varying from 5 to 50 per cent, and in some cases amounting to total destruction of a crop. The campaign against injurious insects other than the boll weevil is therefore becoming of much more importance than heretofore. The fruit-growing industries, for example, cannot be successful, one year with another, unless the fruit-growers possess reliable information regarding the methods of controlling the insects which yearly threaten the fruit crop.

It is unnecessary to call attention to the many insect enemies which affect sugar cane, corn, alfalfa, pecans, oranges, garden and truck crops, etc., which annually levy a heavy toll. Many of these insects are practically unknown, so far as their development, habits and natural enemies are concerned, and until they have been carefully studied means cannot be successfully devised for mitigating the damage for which they are responsible.

The experience of other States has shown that in the past the average annual destruction by insects has been equivalent to at least 10 per cent of the agricultural products. The value of Louisiana's agricultural produce, exclusive of live stock, is approximately $111,000,000 per annum. The insect damage in Louisiana is undoubtedly higher than the 10 per cent mentioned, owing to the fact that insects, both sub-tropical and temperate in their distribution, occur here in unusual numbers, and also owing to the fact that several extremely destructive pests have already been introduced into the State from foreign countries.

The damage by insects in the State of Louisiana must exceed ten millions of dollars annually. Space cannot be taken here to present statistics regarding the insect damage done to various crops and products, but it is sufficient to call attention to the fact that an unlimited field is here presented for the State Crop Pest Commission to bring about a saving of thousands of dollars annually to our farmers and planters by furnishing them with reliable information concerning the means by which these enemies may be controlled or destroyed.

The Secretary, therefore, has no recommendation to make, other than that the Commission continue actively the work begun, and by preventing the dissemination of dangerous insect enemies by suitable quarantine measures, by investigating and devising remedies for insect pests and by disseminating information regarding remedial steps, continue to reduce the enormous losses being suffered from enemies already with us and to protect the agriculture of the State against other enemies which may in the future threaten the prosperity of our farmers and fruit-growers.

SUPPLEMENTARY REPORT.

Financial Statement.

1904.

	Cr.	Dr.
Receipts from State Treasurer.........		$10,000 00
By per diem and expenses of Hon. B. W. Marston, Commissioner ....$	256 75	
Per diem and expenses of Hon. L. S. Frierson, Commissioner	243 60	
Expenses of Hon. J. G. Lee, Commissioner	20 30	
Salary, Entomologist and Secretary..	200 00	
Salaries, Assistant Entomologists and Inspectors	232 53	
Salary, clerk and stenographer......	135 00	
Traveling expenses of Entomologist.	292 69	
Traveling expenses of Assistant Entomologists	323 25	
Field experiments..................	55 94	
Postage	74 69	
Telephone service	5 45	
Express and freight..............	32 80	
Publications	1,313 24	
Stationery and printing	368 04	
Office expenses	295 12	
Rent	127 50	
Laboratory apparatus and expenses..	74 16	
Furniture	76 05	
Rental paid farmers in Sabine Parish on cotton lands..................	5,072 80	
Contingent and miscellaneous expenses	65 65	
Total expenditures, 1904...........$	9,265 56	
Bills receivable, December 31, 1904..	90	
Cash balance on hand December 31, 1904	733 54	
	$10,000 00	$10,000 00

Financial Statement.

1905.

	Cr.	Dr.
Balance on hand January 1, 1905		$ 733 54
Receipts from State Treasurer, January 1, 1905, to December 31, 1905		15,000 00
By per diem of Hon. B. W. Marston, Commissioner	$ 350 00	
Traveling expenses of Hon. B. W. Marston, Commissioner	380 05	
Per diem of Hon. L. S. Frierson, Commissioner	55 00	
Traveling expenses of Hon. L. S. Frierson, Commissioner	32 60	
Traveling expenses of Prof. W. R. Dodson, Commissioner	12 40	
Salary, Entomologist and Secretary	214 39	
Salaries, Assistant Entomologists	2,021 44	
Salary, clerk and stenographer	687 02	
Traveling expenses of Entomologist	369 91	
Traveling expenses of Assistant Entomologists	1,720 94	
Field experiments	675 99	
Postage	190 06	
Telephone service and telegrams	112 20	
Books and technical magazines	370 99	
Express and freight	117 02	
Stationery	89 76	
Publications	264 52	
Printing of regulations, records, blank books, etc	238 65	
Office expenses	531 78	
Rent	418 45	
Electric current (lights)	15 55	
Laboratory apparatus and expenses	1,010 87	
Furniture	610 07	
Cotton seed for distribution in Sabine Parish	587 84	

Financial Statement, 1905—*(Continued).*

Contingent and miscellaneous expenses	$ 112 43	
Total expenditures	$11,189 93	
Cash on hand December 31, 1905	4,071 11	
Bills payable, December 31, 1905	1 50	
Accounts to credit of Commission, December 31, 1905	471 00	
	$15,733 54	$15,733 54

The State Crop Pest Commission of Louisiana

Was established by the Extra Session of the Louisiana Legislature of 1903, by Act No. 6, Approved December 15th, 1903, for the purpose of promulgating and enforcing Rules and Regulations intended to prevent the introduction and dissemination of insects and diseases inimical to the crops and fruits of the State, to investigate seriously injurious insects or diseases occurring within the State, to devise ways and means for their control or eradication and to publish bulletins and in other ways disseminate information regarding the insects and diseases injurious to fruits, crops, etc.

The Circulars of the Commission are issued from time to time as the result of the investigations being made and whenever such publication is deemed advisable in order to place reliable information in the hands of planters, fruit-growers and farmers regarding certain injurious insects or diseases. These Circulars are sent free of charge to all farmers and fruit-growers in the State who make application therefor. Applications for these Circulars, as well as for copies of the Regulations of the Crop Pest Commission, or of the Act No. 6 establishing the Commission, when these latter are desired, should be made to the Secretary of the Commission (Baton Rouge, La.).

Circular No. 3, November, 1905, contains a discussion of the cultural remedies to be used against the boll weevil and should be secured by every cotton planter and farmer in the State of Louisiana.

Circular No. 4, December, 1905, describes the San Jose scale, a serious insect enemy of fruit trees, and gives the means by which it may be controlled. All fruit-growers should write to the Secretary of the Commission for a copy.

Circular No. 5, January, 1906, contains a general discussion of the boll weevil situation, and the lines along which Louisiana's campaign against this insect is being conducted.

Circular No. 6, February, 1906, is "A Preliminary Report on the Horseflies of Louisiana, with a Discussion of Remedies and Natural Enemies." This paper is of special interest to those interested in live stock.

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CIRCULAR NO. 8

OF THE

State Crop Pest Commission

OF

LOUISIANA.

Report of the Executive Committee upon the Paris Green Experiments Conducted Against the Boll Weevil During 1905

BY

B. W. MARSTON, L. S. FRIERSON
AND
WILMON NEWELL.

ISSUED BY THE
STATE BOARD OF AGRICULTURE AND IMMIGRATION,
CHAS. SCHULER, Commissioner.

BATON ROUGE:
The Times, Official Journal of Louisiana.
1906.

State Crop Pest Commission of Louisiana.

ORGANIZATION.

Hon. Newton C. Blanchard, Governor of Louisiana, Baton Rouge.

Hon. Chas. Schuler, Commissioner of Agriculture, Baton Rouge.

Prof. W. R. Dodson, Director of the Louisiana Agricultural Experiment Stations, Baton Rouge.

Hon. L. S. Frierson..Frierson.

Hon. B. W. Marston..Eastpoint.

Wilmon Newell, Entomologist of the Louisiana Agricultural Experiment Stations; Secretary and Entomologist of the Commission, Baton Rouge.

J. B. Garrett, }
C. W. Flynn, } Assistant Entomologists and Inspectors, Baton Rouge.
E. C. Cotton, }
Harper Dean, Jr., }

Miss L. E. Renneker, Clerk and Accountant, Baton Rouge.

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THE TIMES, OFFICIAL JOURNAL OF LOUISIANA.
1906.

LETTER OF SUBMITTAL.

KEACHIE, LA., May 16, 1906.

SIR—I beg to submit herewith the report of the Executive Committee upon the Paris green experiments which were conducted at Keachie, La., during 1905, to determine the value of this substance as a remedial agent in the campaign against the boll weevil.

Respectfully submitted,

WILMON NEWELL, Secretary.

Hon. Chas. Schuler, Commissioner of
Agriculture, Active Chairman, State
Crop Pest Commission of Louisiana.

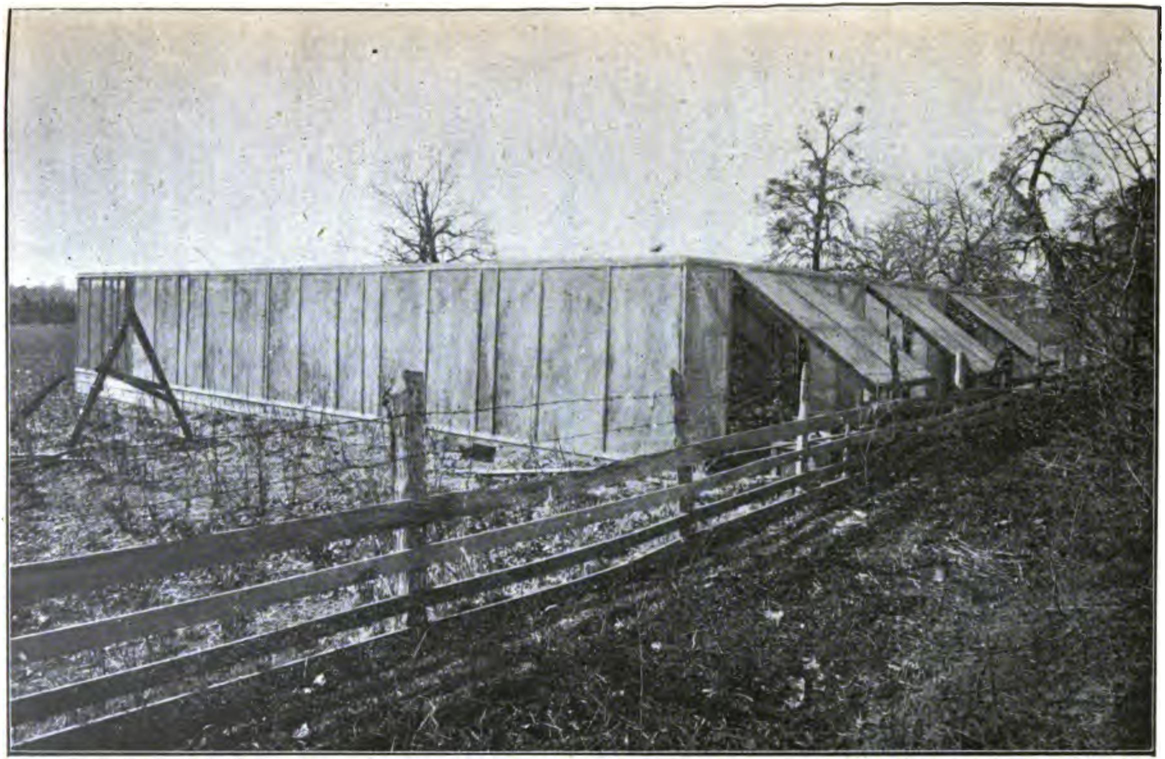

Fig. 1.—The large cages madeof wire cloth, at Keachie, La., in which the "Cage Experiments" with Paris green were conducted.

State Crop Pest Commission
OF LOUISIANA.

CIRCULAR No. 8. May, 1906.

The Circulars of the State Crop Pest Commission are sent free of charge to all farmers and fruit growers of Louisiana who make application therefor.

Report of the Executive Committee upon the Paris Green Experiments Conducted against the Boll Weevil During 1905.

BY

B. W. MARSTON, L. S. FRIERSON AND WILMON NEWELL.

At its meeting January 17, 1905, the State Crop Pest Commission directed that experiments should be made during the season of 1905 in which the efficiency of Paris green as a remedial agent against the boll weevil should be tested as thoroughly and completely as possible, these experiments to be under the immediate supervision of the Executive Committee, and the results to be verified and compiled by it.

As to the exact manner in which these experiments were to be carried on, no instructions were given your Committee, the plans and details being left for it to decide upon.

The season of 1905 was an exceedingly backward one, the spring being wet and cold, so that farm operations were greatly delayed. The weevils could not be found at Keachie* until after the cotton plants had commenced putting on squares, although all preparations had been made for testing the effect of Paris green when applied before squares became available for feeding and egg deposition by the weevils.

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*The first infestation found in the vicinity of Keachie in 1905, was on July 1st, when Mr. C. W. Flynn discovered a few eggs and small larvae in squares.

Your Committee, therefore, wishes to direct particular attention to the fact that these experiments did not include any test of the poison during the period between the appearance of the cotton above ground and the production of the first squares, and that they therefore furnish no direct evidence as to whether or not the application of Paris green prior to the formation of squares may or may not be profitable.

THE CAGE EXPERIMENTS.

As Mr. Marston claimed that the greatest obstacle to demonstrating the complete destruction of the weevils in any given field by poisoning was the tendency of adult weevils in adjoining unpoisoned fields to come in and reinfest the poisoned cotton, it was deemed advisable by your Committee that some, at least, of the experiments should be conducted under conditions making reinfestation of the poisoned cotton impossible. As isolated infested fields were difficult to find, and as such fields did not make it possible to utilize, for comparison, unpoisoned fields on the same soil and under similar conditions, the plan of experimenting in large weevil-proof cages was adopted as the only available one in which the danger of reinfestation could be eliminated.

Accordingly, three cages (see Fig. 1), each 16 feet wide and 64 feet long, were constructed over growing cotton upon the farm of Mr. J. T. Fisher, two miles north of Keachie, La.

The cotton over which the cages were constructed was planted May 1 with King's improved seed,* 300 pounds of "10-2-2" fertilizer per acre being applied in the drill prior to planting. The cotton was "barred off" on May 16 and 17, and was chopped out between May 22 and 24. It was plowed with sweeps on May 25 or 26, and again between June 1 and 3.

The cages were constructed over the cotton June 13 to 16, inclusive, before any boll weevils had appeared in this locality, and upon their completion were closed and locked, so that the accidental entrance of weevils into them became impossible. For convenience the cages were numbered as follows:

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*Partially mixed with "native," or "gin" seed.

No. 1.—The easternmost cage, in which the earliest and heaviest applications of Paris green were subsequently made.

No. 2.—The "middle" cage, in which later and lighter applications of Paris green were made.

No. 3.—The western cage, to which no applications of Paris green were made at any time, the cotton in this cage being left untreated to serve as a "check," for comparison with the poisoned cotton in Cages 1 and 2.

Mr. J. B. Garrett, Assistant Entomologist, made the counts and records of infested and non-infested squares and bolls at different times throughout the season, and also kept the records of cotton picked at different dates, with the exception of the picking and weighing of seed-cotton upon October 30, which was made by the "Planters' Committee" that examined the experiments upon this date.

The Executive Committee did not deem it wise to import weevils from infested Texas or Louisiana localities for use in this experiment, as, owing to the failure of the weevils to reappear in the vicinity of Keachie, it was thought that this neighborhood might remain free from them until late in the season, and the Committee did not wish to take any chance of introducing them.

This failure of the weevils to emerge early from their hibernating quarters not only made tests of Paris green prior to squaring of the plants impossible, but also deferred the beginning of the entire experiment until the plants had been producing squares and blooms for some time.

No weevils were obtained until July 13, when Messrs. Marston and Garrett collected fourteen weevil-punctured squares in a neighboring field and placed seven of them in Cage No. 1, four in Cage No. 2, and three in Cage No. 3.

Mr. Marston placed twenty-four weevil-punctured squares in each cage on July 19, and thirty-eight in each cage on July 27. At this time, also, Mr. Marston made two applications of Paris green to the cotton in Cage No. 1, two ounces (five and one-quarter pounds per acre) being applied on July 19, and one ounce on July 27.

Placing in tabular form the dates upon which punctured squares were placed in each cage, we have:

TABLE A.

Number of Weevil-Punctured Squares Placed in Cages 1, 2 and 3.

Cage	Date.	Number of Punctured Squares Introduced.	Total Number Introduced.
No. 1	July 13	7	
	July 19	24	
	July 27	38	69
No. 2	July 13	4	
	July 19	24	
	July 27	38	66
No. 3	July 13	3	
	July 19	24	
	July 27	38	65

It will be noted that adult weevils were not liberated in these cages, but that weevil-punctured squares were used as the source of weevil supply, it being assumed that the different lots of punctured squares would contain, and mature, the same number of weevils. It is unfortunate that adult weevils, or at least squares containing egg-punctures only, were not used, for, owing to the not infrequent similarity between feeding and egg-punctures, there is no assurance furnished us that the seventy (in round numbers) squares placed in each cage furnished the same number of adult weevils.

In addition to the application of two ounces of Paris green in Cage 1 on July 19 and one ounce on July 27, one ounce of Paris green was applied by Mr. Marston to the cotton in Cage No. 1 on August 7, and again on August 18, at the rate of one-quarter pound per acre. In Cage No. 2 on August 7 one ounce was applied, and on August 18 another application was made at the rate of one-quarter pound* per acre.

For ready comparison these applications are tabulated in Table B:

TABLE B.

Dates of Application of Paris Green in Cages, and Amounts Applied.

Cage	Date of Application.	Amount Applied.	Equivalent in Pounds Per Acre.	Total Per Acre During Season
No. 1	July 19	2 ounces	5¼	
	July 27	1 ounce	2⅝	
	Aug. 7..........	1 ounce	2⅝	
	Aug. 18........	1-10th ounce	¼	10¾ lbs.
No. 2	Aug. 7..	1 ounce	2⅝	2⅞ lbs.
	Aug. 18........	1-10th ounce	¼	
No. 3	....	None	....	None

At the time the first application of poison was made, July 19, the cotton in all of the cages was of similar size and appearance. The three cages were side by side, upon the same soil and with the same drainage. All had been planted with the same seed, were equally fertilized and had received the same care and cultivation. All were equally shaded by the fourteen-mesh wire cloth of which the cages were constructed, and there was at this time nothing to indicate that any difference in growth, vigor or productiveness could be expected in the different cages.

The first visit to the cages for the purpose of noting results was made by Messrs. Marston and Garrett upon August 1. At this time the cotton in Cage No. 1 presented an unhealthy appearance, and many of the leaves were blackened and were falling off, while the plants in Cages 2 and 3 were growing vigorously and presented a normal, healthy appearance. It was intended that the percentages of infestation should be determined at this date, but, owing to the rigorous quarantines which were imposed at this time, the first count of infested and non-infested bolls and squares was unavoidably postponed until August 10.

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*Estimated.

In order to economize space and to facilitate comparison, the results of the various counts by Mr. Garrett are brought together in Table C, accessory notes upon the conditions prevailing in each cage at the time of counting being referred to in the footnotes accompanying the table.

In making these counts every boll and square in each cage was examined and counted, and the figures given are therefore absolute, not estimated.

TABLE C.

Number of Weevil-Infested and Non-Infested Bolls and Squares in Cages 1, 2 and 3 at Different Dates.

Date.	Cage No.	Bolls Not Infested.	Bolls Infested.	Squares Not Infested.	Squares Infested.	Per Cent of Bolls Infested.	Per Cent of Squares Infested.	Per Cent of Bolls and Squares Infested.	See Footnote.
Aug. 10....	3	930	....	771	53	....	6.43	3.1	a
Aug. 11....	2	895	5	655	37	.55	5.34	2.6	a
Aug. 11....	1	535	....	280	15	...	5.08	1.8	a
Aug. 21....	3	1,291	7	1,442	98	.53	6.36	3.6	b
Aug. 22....	2	1,061	9	742	22	.84	2.87	1.6	b
Aug. 22....	1	763	....	862	3	....	.34	.18	b
Sept. 1 ...	3	1,719	45	295	153	2.5	34.15	8.9	c
Sept. 1..	2	1,200	4	173	13	.33	6.98	1.2	c
Sept. 1....	1	1,028	....	401	1	....	T*	T	c
Sept. 13..	3	1,565	135	108	94	8.	46.5	12	d
Sept. 13..	2	1,221	8	105	11	.65	9.4	1.4	d
Sept. 13..	1	1,173	2	225	....	T	....	T	d
Sept. 20..	3	841	117	53	143	12.21	72.95	22	e
Sept. 20..	2	504	4	118	13	.8	9.92	2.6	e
Sept. 20..	1	641	1	243	4	T	1.6	.56	e
Oct. 10....	3	447	116	334	217	20.6	39.38	29	f
Oct. 10....	2	314	6	404	16	1.87	3.8	2.9	f
Oct. 10....	1	574	....	411	....	....	....	.... (T)	f

*Trace only of infestation.

a (August 10).—The cotton in Cage No. 3 at this time presented a healthy appearance and was growing vigorously. The leaves were all green and there was no tendency towards shedding. Stalks were large, erect and fruiting well. It was similar to the cotton in the surrounding field except that it was somewhat greener than the latter and inclined to be higher, evidently because of the shade afforded by the wire cloth of the cage.

The cotton in Cage No. 2 (which had received it first application of Paris green four days previously) presented no differences in appearance or size as compared with that in Cage No. 3.

In Cage No. 1 (which received Paris green on July 19 and 27), however, a very different state of affairs existed. The cotton leaves were withered and burned and many of them had fallen from the plants. The plants presented a sickly appearance and were practically at a stand-still so far as fruiting was concerned. Plant lice were exceedingly abundant, their predaceous enemies, the lady-bugs, having been destroyed by the Paris green. The leaves were well covered with honeydew secreted by the lice. In both Cages 3 and 2 there was an abundance of lady-bugs and the cotton lice were hardly noticeable.

b (August 21).—The cotton in Cage 3 was still in a thriving condition and had, despite having a much larger weevil infestation than the other cages, continued fruiting, as shown by its total of 2733 uninfested bolls and squares, compared to 1803 uninfested bolls and squares in Cage 2 and 1625 in Cage 1. Some plant lice were present in Cage 3 at this time, but were practically no more abundant than in the open field-cotton outside the cages. Lady bugs and their larvae were abundant.

In Cage 2 a remarkable change had taken place since Aug. 11. This cage had received Paris green on Aug. 7th and 18th. The leaves were now blackened and were falling from the plants as they were doing in Cage 1 on Aug. 11th, although the set-back to the plants in this cage did not appear to be as severe as the check which was given to those in Cage 1. Plant lice had become very numerous and the lady-bugs had almost entirely disappeared. Except in the degree of injury, this cage followed precisely the course of Cage 1, poisoned earlier.

In Cage 1 the cotton was in very poor condition, the stalks being small and slender, often falling over because of insufficient strength to support the comparatively light fruitage. The lice were still abundant and doubtless were instrumental in still further reducing the vitality of the plants. A black fungus had now obtained foothold in the honey-dew secreted by the lice and this fungus covered the entire plant with a sooty mold. This sooty appearance also covered the ground beneath the plants, as well as the rotting leaves which had fallen prematurely on account of the Paris green application. Comparison of the figures for Cages 3, 2 and 1 shows that in No. 1, first poisoned, there was a steady decrease in both the total number of infestations by the weevil and in the percentage of infestation. A decrease in infestation in Cage 2, although less marked, is apparent. At the same time the number of squares and bolls in the different cages shows that the unpoisoned cotton in Cage 3 had rapidly outgrown and out-fruited that in the other two cages.

c (September 1).—The increase in infestation in Cage 3 is seen to have been very rapid since August 21, the percentage of square-infestation having increased over five-fold and the percentage of boll-infestation over four-fold. While the increase of uninfested bolls is still very apparent there is seen a very marked decrease in the number of uninfested squares. This was possibly due not only to the greater number of weevils in this cage, but in part also to the fact that these plants, having already set a fair crop of bolls, naturally showed a lessened square production. At this date the cotton in Cage 3 was still in much better growing condition than in the other cages and plant lice were far less abundant. Adult weevils were much more abundant than in Cages 1 and 2.

Cage 2, unlike Cage 3, showed a marked decrease in the number of infested squares, and the decrease of uninfested squares (from 742 on Aug. 22 to 173 on Sept. 1) cannot therefore be charged to weevil damage as in Cage 3. Neither is this decrease of 569 uninfested squares in nine days' time, ascribable to a tendency on the part of the plant to lessen square-production because of the fruitage already made, as only 1200 bolls had been set in this cage up to this time. This rapid decrease in squares appears to be chargeable only, and directly, to the effects of the Paris green applications, and this is amply supported by the conditions prevailing in this cage Sept. 1, the plants having lost their green healthy appearance and having shed many leaves and squares, while the lice and honey-dew had become abundant.

The weevil infestation in Cage 1 had now been reduced to practically nothing, only one punctured square and one adult weevil being found. The plants had now commenced to recover from the injury they had previously shown and the young bolls were not falling off nearly as rapidly as they had been. The bolls remaining upon the plants were small and did not average more than two-thirds as large as the bolls in Cage 3, and, as was found later, many more of them were required for the production of a pound of seed-cotton. Fresh squares and leaves were being formed near the tops of the plants, but many of the squares were small and seemed to be deficient in vitality. Very few stalks were standing, most of them having fallen over because of the main stem being too small and slender to support the top growth.

d (September 13).—The cotton in Cage 3 was at this date still growing nicely, but the number of infested squares had decreased from 153 (on Sept. 1) to 94. At the same time there had been an increase in the number of infested bolls, and an increase in the percentage of square-infestation from 34.15 (at the previous counting) to 46.5. With a decrease in square-production and a continued increase in the weevils it was to be expected that the square-production would be rapidly approached by the weevil-infestation. As many bolls had now opened, all cages showed a decrease (which continued to the end of the season) in the number of bolls carried by the plants.

Cage 2, on Sept. 13, had commenced to partially recover from its injury. Some fresh squares and leaves were being formed but the squares appeared very small and of little account. Plant lice had decreased considerably and lady-bugs were now more abundant in this cage than they had been at any time since poisoning commenced.

In Cage 1 the conditions were not materially different from what they were on Sept. 1st, there having been a slight increase in bolls and a decrease in squares.

A comparison between Cages 1 and 3 at this time is of interest. Despite the heavy weevil infestation (46.5 per cent of squares and 8 per cent of bolls) in Cage 3, unpoisoned, and the practical absence of infestation in the heavily poisoned cage (No. 1), the former presents a total of 1673 (1565 plus 108) non-infested bolls and squares against 1398 non-infested in Cage 1. The unpoisoned cotton, with a steadily increasing weevil infestation to contend with, had considerably out-stripped the poisoned cotton having no weevil infestation but having, on the other hand, to contend with the primary injury by the poison itself and the damage by the hordes of cotton lice.

e (September 20).—Upon this date the cotton in Cage 3 was still ahead of that in the other two in general appearance and vigor as well as in the number of uninfested bolls produced. Square-production, on the other hand, was now rapidly decreasing, these plants having "set" the greater part of their fruitage. An important point to be noted here is that this unpoisoned cotton produced its crop early in the season and by rapid growth and maturity kept ahead of the rapidly increasing weevil-infestation. Adult weevils were now abundant in this cage and were puncturing not only squares, but many small and half-grown bolls as well.

The cotton in Cage 2 at this date was in much worse condition than in either of the other cages. Having been poisoned later in the season than Cage 1, it had not put out as much of new growth as had that in Cage 1.

In Cage 1 there was now practically no weevil infestation, only one square and four bolls being found infested. Although the cotton had recovered some from the effects of the poison, it had never regained the vigorous growth which it had before the poison was applied.

The first picking of cotton from these cages was made at this time, 8 1-2 pounds being picked from Cage 3, 8 pounds from Cage 2, and 5 1-2 pounds from Cage 1. The amount of cotton picked was by no means proportionate to the number of open bolls, the bolls in Cage 3 being much larger than those in Cage 1 and a smaller number of them accordingly were required to furnish a pound of seed-cotton.

f (October 10).—The percentage of infestation of squares in Cage 3 had decreased since previous counting from 72.95 per cent to 39.38 per cent. This decrease is apparent only, for the weevils continued to increase, as is shown by the fact that there were now 217 infested squares in the cage as against 143 on Sept. 20. The decrease in percentage of infestation was due to the rapid increase of squares (from 196, 53 plus 143 to 551, in Cage 3) which followed the autumn rains, this increase in squares being apparent in all three of the cages.

In this counting, made Oct. 10, opened bolls, from which the cotton was picked on Sept. 20, were not counted.

The cotton in Cage 2, upon Oct. 10, was of the same general appearance as that in Cage 1, being sickly and having a weak, slender stalk. Both Cages 1 and 2, like No. 3, were putting on additional squares as a result of the increased rainfall.

Squares produced at this late date could not mature lint before the usual date of frost, and their production at this time is of no importance. Even assuming that all of these squares would produce cotton before frost, the unpoisoned cage shows an increase of 281 non-infested squares since Sept. 20, as against an increase of but 186 non-infested squares in Cage 1.

To what extent, if any, the shading by the wire cloth of the cages was responsible for the severe damage by the Paris green can only be surmised. The unpoisoned cotton in Cage 3 grew even more vigorously and luxuriantly, as well as fruited better, than the field-cotton of the same variety, planting, etc., outside the cage and but a few feet away from it. It appears not at all improbable that the slight protection from the hot summer sun and winds afforded conditions very favorable to the growth of the plants, as the partial shade of dead trees is known to be beneficial. That conditions which favor healthy, vigorous growth of the plants and increase their productiveness should at the same time increase their susceptibility to injury by any substance that might be applied to them would seem almost paradoxical.

The size of the plants and their appearance will be noted from Figs. 2, 3 and 4, which show the cotton in Cages 1, 2 and 3, respectively, as it appeared October 30.

TABLE D.

Pounds of Seed-Cotton Picked from Cages 1, 2 and 3.

Date.	Cage No. 1.	Cage No. 2.	Cage No. 3.
Sept. 20	5½	8	8½
Oct. 10	1½	3	4
Oct. 30	1.65	1	2.6
Nov. 14	1	½	1
Total	9.65	12½	16.1
Equivalent in lbs. seed-cotton per acre*	406	525	676

(*Each cage contained 1-42 of an acre.)

TABLE E.

Amount of Seed-Cotton Produced by Each Cage Up to and Including Date of Each Picking.

Date.	Cage No.	Pounds Seed-Cotton Picked from Cage (up to and Including Date in Left-Hand Column)	Equivalent in Pounds Seed-Cotton Per Acre.	Total Crop. Per Acre. for Season.
Sept. 20	1	5½	231	406
	2	8	336	525
	3	8½	357	676
Oct. 10	1	7	294	406
	2	11	462	525
	3	12½	525	676
Oct. 30	1	8.65	363	406
	2	12	504	525
	3	15.1	634	676
Nov. 14	1	9.65	406	406
	2	12½	525	525
	3	16.1	676	676

Table E presents facts that permit of some interesting comparisons. The greater rapidity with which the unpoisoned cotton in Cage 3 produced its crop, with early maturity, is evident. By October 10 the unpoisoned cotton had produced as much as the lightly poisoned cotton (Cage 2) produced during the entire season, and 124 pounds per acre more than the heavily poisoned cotton (Cage 1) produced during the entire season.

From a close study of the figures given above, and after having observed the progress of the cage experiments through the season (see Table C), the following conclusions seem justified:

1. The application of 10 3-4 pounds of Paris green per acre, in four applications, to cotton having squares, blooms and bolls, when reinfestation from other sources was prevented, killed practically all boll weevils.

2. The application of 2 7-8 pounds per acre, in two applications, resulted in a marked decrease in the number of boll weevils' and a corresponding decrease in the percentage of infestation.

3. The application of the 10 3-4 pounds of Paris green per acre during July and August resulted in injury to the cotton and checked its growth. As a result of this application of Paris green the cotton yielded 270 pounds (seed-cotton) per acre less (by comparison with Cage 3) than it would have yielded had no poison been applied.

The application of the relatively small amount of 2 7-8 pounds of Paris green per acre during August resulted in injury to the plants and caused the cotton in this cage (No. 2) to produce 151 pounds per acre less than the weevil-infested, unpoisoned cotton.

Whether this damage would always follow in practical work is not yet proven; it is probable that it does not always occur.

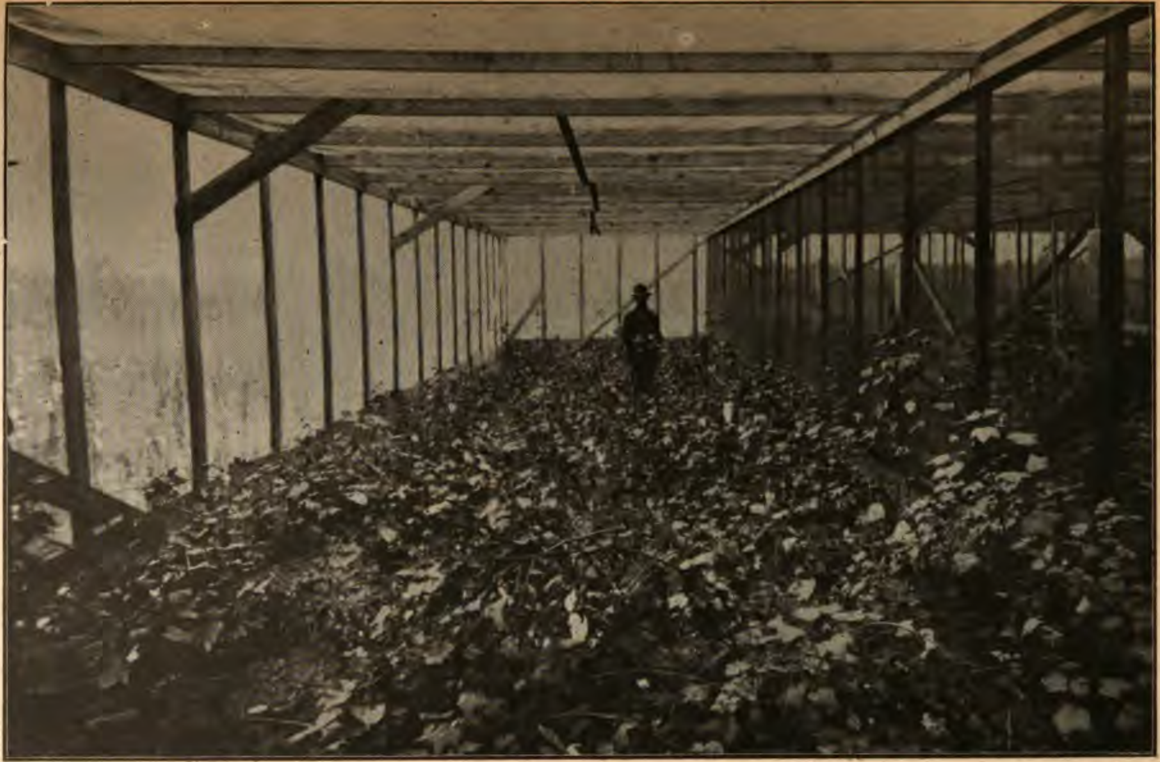

Fig. 2.—The cotton in cage No. 1 (heavily poisoned), as it appeared October 30, 1905. (Photographed by Dr. W. E. Hinds.)

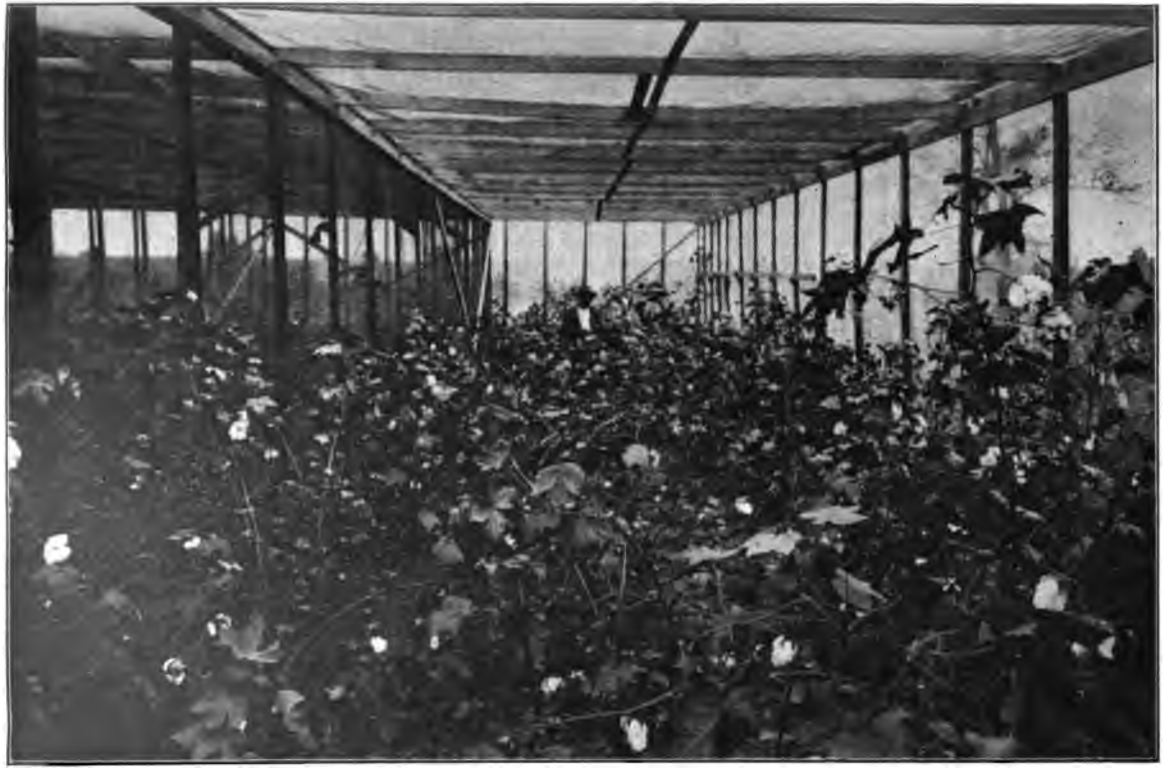

Fig. 4.—The cotton in Cage No. 3 (not poisoned), as it appeared October 30, 1905. (Photographed by Dr. W. E. Hinds.)

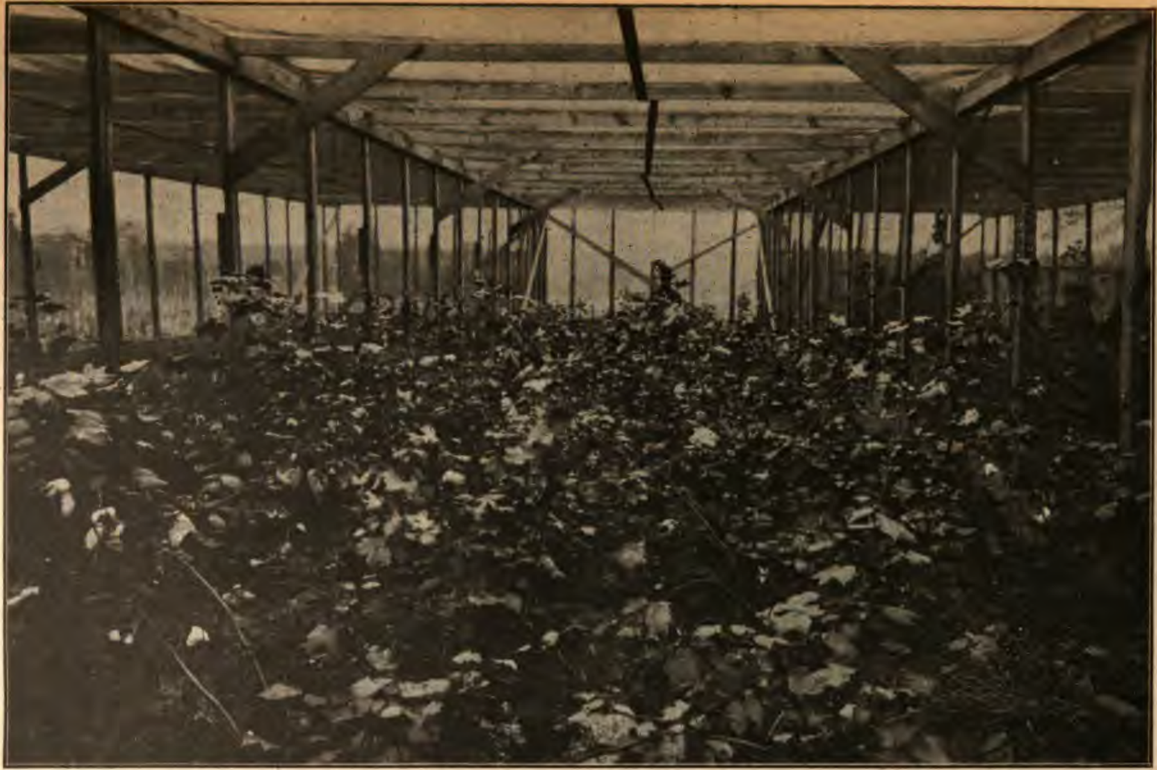

Fig. 3.—The cotton in Cage No. 2 (lightly poisoned), as it appeared October 30, 1905. (Photographed by Dr. W. E. Hinds.)

THE FIELD EXPERIMENT.

In addition to the cage experiments, discussed above, the Committee decided early in the season to experiment with Paris green under open field conditions, to see whether or not the results obtained in the cages would be duplicated in the field, where reinfestation was possible.

About midsummer Captain B. W. Marston, of the Committee, made arrangements for a summer test of Paris green upon the farm of Mr. E. L. Johnson, located nine miles southwest of Keachie, La.

In this experiment Mr. Marston selected the field to be poisoned and the one to be used for comparison, the latter receiving no application of Paris green at any time.

The plat selected for poisoning contained 12.8 acres. A part of it had been in cultivation three years and a part four years. The soil would be characterized as good upland, and fertilizer was not used. This field was planted with Bohemian big boll cotton about April 20, and was given about three plowings and two choppings, which is near the average cultivation in that neighborhood.

A short distance from this poisoned field another field, on similar soil, was selected as a "check." This field contained 11.9 acres, and had been in cultivation about eight years, hence its natural fertility had been somewhat diminished. One hundred and twenty-five pounds of phosphate and 400 pounds of cotton seed were applied per acre shortly before planting. King seed, mixed with "native" seed, was planted about April 8.

The experiment was commenced on August 2, at which time there was considerable infestation in both fields, being, however, localized, i. e., occurring heavier in some parts of the field than in others.

The attempt was made to apply approximately two pounds per acre at each application. At the outset it was supposed that the field contained 16 acres, whereas the actual survey, made after the various applications of poison were made, showed that it contained but 12.8 acres. It is quite possible, therefore, that something over the exact two pounds per acre were applied. In addition to this application, two pounds per acre were made on August 8, and two pounds on August 18.

Examinations were made from time to time during the summer by Mr. J. B. Garrett to determine the infestation in both the poisoned and unpoisoned fields.

To get an approximate estimate of the percentage of infestation in each of these plats, a method was adopted at the first examination which appeared most likely to make ready comparisons possible. This method was as follows; different locations were selected in the plat and five average stalks of cotton were chosen in each location, and the total number of bolls and squares on these were counted, the number of each infested being at the same time determined. While this method did not give figures which were mathematically exact, as did the count of absolutely all squares and bolls in the cage experiment, still it can be relied on for all practical purposes in making a comparison of the two plats. To give a comprehensive idea of how this method was applied, the results of examining plants in different parts of both poisoned and unpoisoned fields are given in detail in Tables F' and G.

TABLE F.

Weevil Infestation in Unpoisoned Field on August 2.

No. of Plants Examined.	Location.	Bolls Not Infested.	Bolls Infested.	Squares Not Infested.	Squares Infested.
5	N. W. C.*	51	....	43	....
5	W. S.	61	....	71	9
5	S. W. C.	48	....	49	10
5	W. of C.	69	....	53	43
5	N. S.	64	....	69	1
5	Center.	50	....	61	....
5	S. S.	53	....	52	....
5	S. E. C.	71	....	60	....
5	N. E. C.	46	....	53	....
45		513		511	63

*"Northwest corner," "West side," etc.

TABLE G.

Weevil Infestation in Poisoned Field August 2.

No. of Plants Examined.	Location.	Bolls Not Infested.	Bolls Infested.	Squares Not Infested.	Squares Infested.
5	W. S.	15	....	21	12
5	S. W. C.	39	....	54	10
5	W. S.	35	....	50	9
5	N. W. C.	32	....	36	2
5	N. S.	29	....	48	....
5	N. E. C.	27	....	43	....
5	E. S.	25	....	42	....
5	S. E. C.	38	....	45	....
5	S. S.	30	....	33	....
5	W. of C.	23	....	28	18
5	Center.	26	....	39	2
55				439	53

To economize space, these and subsequent examinations are condensed in Table H, Mr. Garrett's notes on the conditions prevailing at the time of each examination being given in footnotes, as in Table C.

TABLE H.

Percentage of Infestation in Poisoned and Unpoisoned Plats from Beginning of Experiment, Aug. 2, to Sept. 22, 1905.

Date.	Plat.	Number of Plants Examined.	Bolls Not Infested.		Bolls Infested.	Squares Not Infested	Squares Infested.	Per Cent of Bolls Infested.	Per Cent of Squares Infested.	See Footnote.
August 2	Check	45	513		....	511	63	....	10.9	a
	Poisoned	55	319		....	439	53	....	10.7	a
August 17	Check	45	515		32	210	93	5.8	30.6	b
	Poisoned	55	368		6	299	45	1.6	13.0	b
August 25	Check	45	457		66	67	68	12.6	50.0	c
	Poisoned	55	405		34	224	52	7.7	18.8	c
September 4	Check	45	468		134	85	53	22.2	38.4	d
	Poisoned	55	457		45	118	34	8.9	22.3	d
September 15	Check	45	438		113	106	129	20.5	54.8	e
	Poisoned	55	477		55	129	121	10.3	48.4	e
			Open	Unopen						
September 22	Check	45	342	79	72	81	128	47.6	61.2	f
	Poisoned	55	176	196	58	129	147	22.8	53.2	f

a (August 2).—Although the infestation was localized in both poisoned and check (unpoisoned) fields at this time (the beginning of the experiment), the percentage of square-infestation was practically identical in both. The check field showed a much greater number of bolls.

b (August 17).—Paris green was applied to the "poisoned" field August 2nd and again on August 8th, each time at the rate of two pounds per acre. The infestation in the check plot is seen to be increasing rapidly and the bolls are now beginning to be infested. The infestation had also spread over the entire field. Only a very light increase in infestation in the poisoned field since August 2nd is noted, but in spite of the two Paris green applications the infestation had spread entirely over this plot also.

Though but fifteen days had elapsed since the first application of poison its injurious effect on the plants was already noticeable, many leaves being severely "burned". Cotton lice were also increasing rapidly, while in surrounding fields none could be found.

c (August 25).—The poisoned field had received its third application of Paris green on August 18th. The general deterioration of the plants in this field was still continuing at this date. An increase in infestation, since the last examination, had taken place, although this increase was not as marked as in the unpoisoned field. In the poisoned field the cotton lice were still on the increase.

d (September 4).—The "check" plot at this date showed a considerable decrease in infestation of the squares, while the poisoned field showed an increase in the infestation of both squares and bolls. In the former the adult weevils were less abundant than formerly.

This is presumably accounted for in the fact that this cotton, having made the bulk of its crop, had ceased making many squares and food supply and favorable conditions for oviposition were not here and the weevils had accordingly migrated to other and later-maturing fields.

From the check field about 4000 pounds of seed cotton had been picked and many matured bolls remained yet to open. This field had at this early date produced what may be considered a fair crop, while in the poisoned field practically no cotton had been picked. The reason for this difference is explained on a subsequent page.

In the poisoned field a great deal of the foliage was black and dropping off. Cotton lice were very abundant and honey-dew covered the foliage. In this honey-dew the black fungus was growing and this latter reached over even the open cotton and to portions of the ground. The ground was well strewn with the black and rotting leaves which had fallen from the plants.

Under field conditions this poisoned cotton followed exactly the course of the heavily poisoned cotton in the cage experiment.

e (September 15).—Examinations on this date showed the percentage of infestation in the poisoned field to be rapidly increasing, 10 per cent of the bolls and 48 per cent of the squares being now infested.

f (September 22).—In this examination both open and unopened bolls were counted, the latter only being taken into account in determining the percentage of infestation.

On October 16 both fields were visited, although counts of infested and non-infested bolls and squares were not continued after September 22, as blooms appearing after that date could not possibly mature cotton by frost in that locality.

All cotton had been picked from the check field before October 16 and cattle had been turned into the field by the owner to eat up any squares that might be formed. In the poisoned field the plants were now green and many squares and blooms were present. This field was literally alive with boll weevils at this date.

The difference in production of the poisoned and unpoisoned fields does *not* accurately represent the decrease in production due to the Paris green applications. An accurate measure of the damage done by the poison could be obtained only by having under observation two fields in which all conditions were identical, except for the application of poison to one of them.

In reality, what this experiment *does* afford us is a comparison between the "cultural methods" (early-maturing cotton, early planting, proper use of fertilizers, thorough cultivation, etc.) on the one hand, and ordinary methods of making cotton, with Paris green alone depended upon for holding the weevil in check, on the other. To make this comparison clearer, the various conditions, treatment, etc., of the two fields are given in Table I:

TABLE I.

Comparison of Poisoned and Unpoisoned ("Check") Fields.

	Poisoned Field.	Unpoisoned Field.
Soil, years in cultivation	Upland, in cultivation 3 or 4 years	Upland, cultivated 8 years.
Fertilizer used	None	525 lbs. per acre.
Seed	Bohemian Big Boll	King andNative.
Date planted	April 20	April 8.
Number of plowings	Three	Three (or four?).
Number of choppings	Two	Two (or three?)
Paris green applied	Aug. 2, 2 lbs. per acre Aug. 8, 2 lbs. per acre Aug. 18, 2 lbs. per acre	None.
Yield, seed-cotton	3,601 lbs.	6,727 lbs.
Acres in field	12.8	11.9.
Yield per acre of seed-cotton	282 lbs.	565 lbs.

The results obtained in the field and cage experiments bring the Committee to the following:

GENERAL CONCLUSIONS.

1. Paris green can be applied to cotton that is blooming and squaring so as to greatly decrease the boll weevils.
2. The amount of Paris green used in these experiments did serious damage to the plants.

In signing this report, Mr. Marston is not satisfied with its general trend. He believes that if Paris green is used early enough it is the greatest discovery yet made to hold the weevil in check.

B. W. MARSTON, *Chairman,*
L. S. FRIERSON,
WILMON NEWELL,
Executive Committee.

Directions For Sending Insects For Identification.

The Entomologist of the Commission is at all times glad to render (always free of charge) every assistance possible in determining the identity of insects and plant diseases and advising measures for their control.

Do not send insects in envelopes or pasteboard boxes by mail; they are inevitably crushed beyond recognition. Send living insects in strong *wooden* or *tin* boxes by mail. No openings are necessary to admit air. Whenever possible enclose some of the food-plant for the insects to subsist on while en route; specimens showing the injury done are desirable. *The name and address of sender should be on every package.* It is against the postal regulations to inclose a letter in a box by mail unless sent at letter postage rate. Specimens of caterpillars, worms, etc., in alcohol or other liquid can be sent by mail *only when in regular mailing tubes.* We will be greatly aided if correspondents writing about insect pests will give as full description of the habits, food-plants, injury and abundance as possible.

Specimens of twigs, living plants with foliage, etc., should be wrapped in damp (not wet) cotton cloth, so as to reach us in fresh condition. Fruits showing injury or disease should be wrapped well with paper and packed in a wooden or tin box.

Correspondents can materially aid the work of this office by communicating with us concerning their success or failure in using the methods advised for controlling injurious insects and diseases, giving a careful detailed account of the methods used and the results obtained. Such information will prove of value to all.

The State Crop Pest Commission of Louisiana

Was established by the extra session of the Louisiana Legislature of 1904, by Act No. 6, approved December 22, 1904, for the purpose of promulgating and enforcing rules and regulations intended to prevent the introduction and dissemination of insects and diseases inimical to the crops and fruits of the State; to investigate seriously injurious insects or diseases occurring within the State; to devise ways and means for their control or eradication, and to publish bulletins and in other ways disseminate information regarding the insects and diseases injurious to fruits, crops, etc.

The Circulars of the Commission are issued from time to time as the result of the investigations being made and whenever such publication is deemed advisable in order to place reliable information in the hands of planters, fruit growers and farmers regarding certain injurious insects or diseases. These Circulars are sent free of charge to all farmers and fruit growers in the State who make application therefor. Applications for these Circulars, as well as for copies of the Regulations of the Crop Pest Commission, or of the Act No. 6 establishing the Commission, when these latter are desired, should be made to the Secretary of the Commission (Baton Rouge, La.).

Circular No. 3, November, 1905, contains a discussion of the cultural remedies to be used against the boll weevil, and should be secured by every cotton planter and farmer in the State of Louisiana.

Circular No. 4, December, 1905, describes the San Jose scale, a serious insect enemy of fruit trees, and gives the means by which it may be controlled. All fruit growers should write to the Secretary of the Commission for a copy.

Circular No. 5, January, 1906, contains a general discussion of the boll weevil situation, and the lines along which Louisiana's campaign against this insect is being conducted.

Circular No. 6, February, 1906, is "A Preliminary Report on the Horseflies of Louisiana, with a Discussion of Remedies and Natural Enemies." This paper is of special interest to those interested in live stock.

Circular No. 7, March, 1906, is "The First Biennial Report" upon the work of the Crop Pest Commission against the boll weevil and other insect pests during 1904 and 1905.

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CIRCULAR NO. 9

OF THE

State Crop Pest Commission

OF

LOUISIANA.

THE BOLL WEEVIL.

Information Concerning its Life History and Habits.

BY

WILMON NEWELL.

Issued Under the Direction of the State Board of Agriculture and Immigration.

CHAS. SCHULER, Commissioner.

BATON ROUGE:
THE TIMES PUBLISHING COMPANY.
1906.

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STATE CROP PEST COMMISSION OF LOUISIANA.

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HON. CHAS. SCHULER, Commissioner of Agriculture.
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CONTENTS

INTRODUCTION. Page.

Present distribution of boll weevil in Louisiana................ 3
Erroneous reports of weevil's occurrence...................... 4
Knowledge of life history, necessity of........................ 4
Appropriation, lack of.. 5

THE ADULT BOLL WEEVIL.

Description of 5
Character by which distinguished from other insects......... 6
Does not breed in acorns, pecans, etc.......................... 7
Has not always been in Louisiana.............................. 7
Feeding habits 8
Has no food except green cotton............................... 8
Is not attracted to lights....................................... 8
Deposition of eggs by.. 9
Rate of egg deposition... 9
Average number of eggs deposited by......................... 10
Life of hibernated adults.. 10
Life of summer adults... 10

THE EGG.

Description of 10
Time required for hatching of.................................. 10

THE LARVA.

Description of 11
Causes flaring and dropping of squares......................... 11
"Natural shedding," how told from weevil work................ 11
Weevil injury, how told from injury by boll worm or square borer 12
Death of larvae, in squares on ground......................... 12
Gathering and burning fallen infested squares................. 12
Length of larval stage... 13

THE PUPA.

Description of 14
Length of pupal stage.. 14
Changes of adult after emergence............................... 14
Appearance of squares after adults emerge therefrom......... 14

CONTENTS—Continued.

SUMMARY OF LIFE HISTORY. Page.

Summer generations 15
Autumn generations 15
Generations not separate or distinct.......... 15
Rate of increase.......... 16

DISSEMINATION.

Artificial dissemination, distinguished from natural.......... 17
Artificial dissemination, can be prevented.......... 18

DISTRIBUTION IN SEED AND HULLS.

From ginneries 18
From oil mills 18
Method of preventing dissemination from oil mills.......... 19
Importance of distribution in seed and hulls.......... 19
Present infestation in Texas and Louisiana—the result of artificial dissemination 19
Eastern Louisiana, protected from infestation by quarantines.. 19

MIGRATION.

First discovery of.......... 20
Relation of to maximum infestation.......... 20
Not in a definite direction.......... 21
Different from other insect migrations.......... 22
Method of determining dates of.......... 23
"Effective temperature," definition of.......... 23
Migrations of October, 1905.......... 24

HIBERNATION.

Does not take place in bolls or squares on plants, in Louisiana.. 27
Time of entering hibernation.......... 27
Favorable hibernating quarters.......... 28
Return to winter quarters, when cotton is not up.......... 28
Time of leaving hibernation.......... 28
Per cent of weevils surviving the winter of 1905-06.......... 28
Movement of adults from field to field after leaving hibernation 29

State Crop Pest Commission

OF LOUISIANA.

CIRCULAR No. 9. July, 1906.

The Circulars of the State Crop Pest Commission are sent free of charge to all farmers and fruit growers of Louisiana who make application therefor.

THE BOLL WEEVIL.

(*Anthonomus grandis* Boh.)

Information Concerning its Life History and Habits.

BY WILMON NEWELL.

The presence of the boll weevil in thirteen parishes of Louisiana,* and the probability that before December it will, by migratory movement, enter several other parishes, makes it advisable to place in the hands of the farmers and planters a brief description of the weevil and its mode of development.

Although the State Crop Pest Commission has published a number of Circulars dealing with the various aspects of the boll weevil problem, a Circular describing the insect more minutely and including recently obtained facts, is now desirable.

---

*The Parishes of Caddo, DeSoto, Sabine, Vernon and Calcasieu are entirely infested at the present writing, while Bossier, Red River, Natchitoches, Winn, Grant, Rapides, St Landry and Cameron parishes are infested in their western portions only. The extreme northwestern part of Acadia is probably lightly infested also.

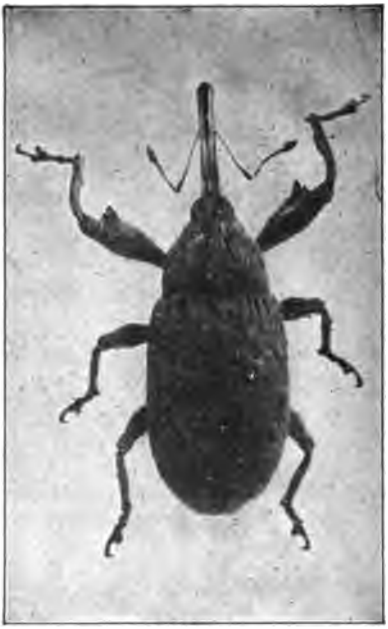

FIG. 1.—Adult boll weevil, much enlarged. (After a photograph by E. Dwight Sanderson).

The many requests received by the Secretary of the Commission for information concerning the habits of the boll weevil amply justify the publication of the present Circular. There are many insects in Louisiana which closely resemble the boll weevil, and from time to time these insects, many of which are harmless to the cotton crop, have been mistaken for boll weevils by the cotton planters and much unnecessary alarm occasioned. In some cases the farmers have plowed up their cotton "for fear of the weevil," and planted the land to other crops or even abandoned it entirely, when not a single boll weevil could be found within many miles of their neighborhood. Perhaps the greatest offender in this regard has been the cowpea-pod weevil* which the present year has been more than ordinarily abundant and which has greatly alarmed the planters and business men in a number of localities. It is thought that the following description and illustrations of the boll weevil and its work will enable anyone, with a little study, to distinguish it from insects resembling it. Erroneous reports of the boll weevil occurring in new localities work injury not only to the farmer but also to nearly all local business interests.

The first step in successfully fighting any insect pest is the attainment of a thorough knowledge regarding its life history and habits, and the farmer who would successfully produce cotton in defiance of the weevil must be thoroughly familiar with the insect and its work, in all stages, in order to comprehend and intelligently apply measures which may be recommended for its control.

**Chalcodermus æneus*, Boh.

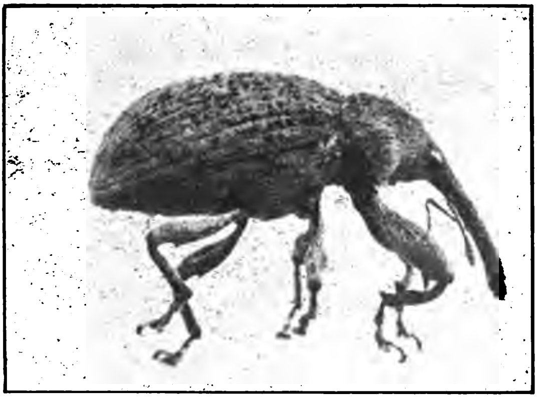

FIG. 2.—Side view of adult boll weevil, much enlarged. (After a photograph by E. Dwight Sanderson).

It is not proposed to discuss remedial measures in this Circular. There has been such a vast amount of knowledge accumulated regarding the boll weevil that no more than one phase of the subject can be treated of in an article of even moderate length. The description of the boll weevil, given below, is therefore in the nature of an introduction to other Circulars which will be issued later in the season by the Commission, and an understanding of the weevil's life history will make these latter more interesting and the more readily understood.

The experiments which are being conducted the present season, although severely handicapped by the fact that the 1906 Legislature made no appropriation for the Commission work, are still being carried on and much new knowledge regarding the weevil is being obtained, most of which will be of the utmost practical value in fighting the pest. The results of this experimental work will be given the planters later in the season, or as rapidly as the experiments are completed and the results compiled.

THE ADULT BOLL WEEVIL.

The adult boll weevil is a beetle about one-fourth of an inch in length and possesses two pairs of true wings which are protected by two elytra or wing-covers (in the case of beetles, what appear to be the "front wings" are in reality only developments of the hard body-covering, under which the real wings are folded when the insect is at rest. These structures are known as "elytra.") The mouth-parts are elongated into a "beak" or snout, at the end of which are the mandibles or biting organs. There is considerable variation in the size of the adults, some being less than three-sixteenths of an inch in length and a few almost three-eighths of an inch long. (See Figure 4.)

The insect is approximately one-third as broad as long. On account of the plump body and elongated snout, the insect is not infrequently referred to as the "little elephant," a nickname which is aptly suggestive of its appearance.

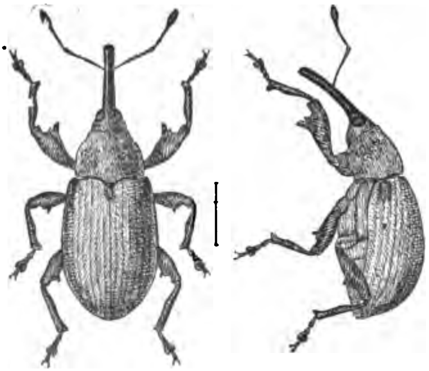

FIG. 3.—Adult boll weevils, *Anthonomus grandis* Boh. (After Hunter, Bul. 45, Bur. of Entomology, U. S. Dept. of Agr.).

Under a magnifying glass the body is seen to be finely ridged, the minute lines and ridges running lengthwise of the body. The surface of the body is covered with small scales, which look like hairs. These scales show very plainly in Figure 2.

The color of the adult weevils varies considerably. When first hatched from the squares they are of a brownish-red color and as they grow older this turns to a dark gray. Freshly-emerged adults showing a yellowish tinge are also frequently noticed. As the adults grow older many of the hair-like scales wear off, exposing the body-surface, causing the weevils to become darker or almost black in color.

The most distinctive structure by which the boll weevil may be recognized is two small spines on the inside of the femur ("first joint") of the front leg. Both these spines are of a deep reddish-brown color, are sharply pointed and one of them is somewhat larger and longer than the other. There are common weevils which have one spine on the femur of the front leg, but no weevil ordinarily found on cotton, except the boll weevil, has two. If both spines are not present one may rest assured that the specimen is not a boll weevil, no matter how close the resemblance may be in other respects.

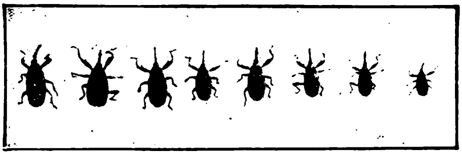

FIG. 4.—A series of adult boll weevils, showing variation in size. (After a photograph by E. Dwight Sanderson).

The cowpea-pod weevil, the acorn weevil, the pecan weevil and a number of others are daily mistaken for boll weevils and their resemblance is so close that a knowledge of the above distinctive character is absolutely essential.

In some sections there exists a popular fallacy to the effect that there is but one species of weevil and that its eggs produce boll weevils, acorn weevils or pecan weevils, according as they may happen to be laid in cotton squares, acorns, pecans, etc. This theory savors of such gross ignorance of commonly-known facts that it deserves no more than passing mention. The egg of a boll weevil cannot possibly develop into an acorn weevil or a pecan weevil. In the first place the female boll weevil has never been known to deposit her eggs elsewhere than in the cotton squares, forms or bolls, and even were she to deposit an egg in an acorn, the resulting larva could never reach maturity because of the food-supply there being totally unadapted to its development.

The frequent finding of acorn and other weevils, most of which are native to the State and have therefore been here for many years, has caused many to express the opinion that the boll weevil has been in Louisiana "always" and that therefore nothing is to be feared from it. The movements of the boll weevil into new territory have been so closely followed and its habits, as well as those of closely related weevils, have been so carefully studied that such a supposition is entirely refuted. The boll weevil itself will, within the next few years, completely convince even the most skeptical that not only is it an insect which has not always been here, but that it is an insect enemy by the side of which other cotton pests are of little consequence.

Upon leaving hibernating quarters in the spring the adults start on their search for growing cotton. If they fail to find the cotton up, some, at least, of them return to winter quarters and emerge again later on. From the time of leaving hibernation until the first squares are formed upon the plants, the adults feed upon the leaves and buds of the cotton. The boll weevil cannot subsist upon any substance other than green cotton, despite the fact that starving weevils when confined with fruits or liquid sweets, will eat them. Boll weevils fed upon apples, peaches, molasses and similar materials do not live appreciably longer than weevils supplied with water only, hence these substances do not serve them as food. Boll weevils fed upon ripe melons or fruits, live longer than weevils kept confined without either food (green cotton) or water, because of the moisture they obtain from these substances.

As soon as squares form upon the cotton plants, both males and females feed voraciously on the squares. The entire square is not consumed, but the weevil punctures the outer coverng of the square and through this opening reaches its beak into the nascent pollen mass within and feeds upon it. A square with a large number of feeding punctures is shown in Figure 5.

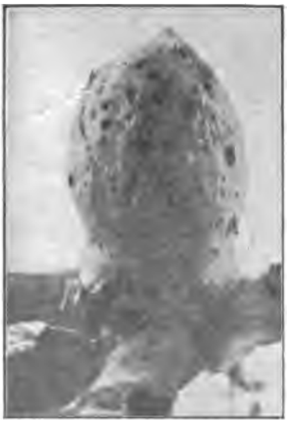

FIG. 5.—Cotton square (with "shuck" removed); showing feeding punctures made by adult boll weevils. (After a photograph by E. Dwight Sanderson).

These feeding punctures are quite unlike the holes made by other cotton-feeding insects and a little practice enables one to recognize them readily, even though the adult weevil itself is not found. While feeding, the weevil frequently leaves a yellowish or orange-colored excrement upon the outside of the square and this also is characteristic in appearance.

The adult boll weevils are active during daylight hours only and do their feeding and depositing of eggs during that time They do not fly or move about at night, nor are they attracted to lights. "Trap lanterns" placed in the cotton fields at night catch a horde of insects, most of which are beneficial (with the exception of bollworm moths, which are occasionally captured), but boll weevils are never captured by these contrivances and their use is a needless expense and waste of time. Entomologists have taken hundreds of thousands of insects at lights in the weevil sections but not a single boll weevil has ever been captured in this manner. In some cases boll weevils on the cotton plants, in the direct glare of the lights, have been observed to remain there quietly all night.

Upon the appearance of the first squares the female weevils commence depositing eggs. Early in the season it is rare that more than one egg is placed in a square and at this time also eggs are only occasionally placed in young bolls. The puncture in the square, through which the egg is inserted, is smaller than the average feeding-puncture, and while the feeding punctures are always left open, the egg-punctures on the other hand, are sealed up by the female immediately after the egg is deposited, with a small amount of secretion. This effectually protects the egg within the square. The plant itself further contributes to this protection by the development of a wart-like structure over the egg-puncture. One of these "warts," covering the egg-puncture, is seen in Figure 6.

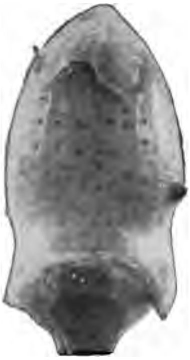
FIG. 6.—Cotton square (with shuck removed) showing egg-puncture and its protective wart-like covering. (After a photograph by E. Dwight Sanderson).

Observations made by Messrs. Hunter and Hinds show that the hibernated female weevils deposit eggs at the rate of from 2 to 5 per day*, the latter number probably being nearer the average rate than the former.

The same gentlemen also found that the hibernated females continued oviposition for an average of 48 days each, and a few continued depositing eggs for as long a period as 90 days. The prevailing temperature doubtless influences to a considerable extent the rate of egg-deposition, and the high temperature of mid-summer, combined with the greater activity of the

*Bul. 51, Bur. of Entomology, p. 86.

weevils at that time, serves to shorten the life of the adults considerably, as hibernated adults were found by Hunter and Hinds to live an average of 70 to 80 days after emergence from winter quarters while adults of the summer generations lived but from 45 to 60 days. The average number of eggs deposited by weevils kept in the laboratory was found to be 139 each.

THE EGG.

The egg of the boll weevil is pearly-white in color and is approximately one-thirtieth of an inch in length by one-fiftieth of an inch in diameter. The surface does not show any markings and the flexible membrane with which it is covered allows it to assume different shapes when pressed in among the pollen masses or anthers within the square. While the appearance of the egg is unfamiliar to most planters, it can be readily seen by carefully cutting away the covering of a recently-punctured square and exposing to view the anthers just beneath the egg-puncture. An ordinary hand-magnifying glass of course assists materially in the examination. A boll weevil egg within a cotton square, is seen in Figure 7.

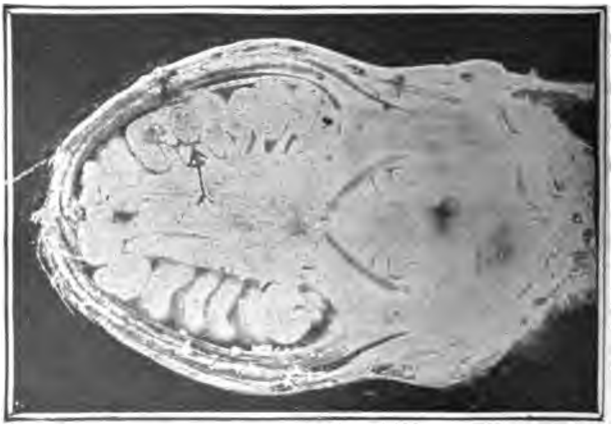

FIG. 7.— Boll weevil egg (indicated by the arrow) within a cotton square. (After a photograph by E. Dwight Sanderson).

The length of time required for the egg to hatch, after being placed in the square, is dependent mainly on the temperature, and the egg-stage is therefore longer in spring and autumn than in mid-summer. During June about 4 days are required for hatching. During July and August this period is reduced to 2 1-2 or 3 days and lengthens out more and more towards the approach of frost. At Victoria, Texas, Mr. Hunter found the egg-stage in November to be as long at 15 days.

THE LARVA.

The egg hatches into a small white grub-like larva, devoid of legs, and but slightly larger than the egg itself. The head and mouth parts are brown in color. The small larva immediately begins feeding upon the pollen sacs with which it is surrounded and in a few days consumes the entire contents of the square. Long before the larva has reached maturity the square has flared and fallen from the plant to the ground. In midsummer the square not infrequently flares soon after the egg is deposited in it, but in the early part of the season the squares, as has been generally observed the present season, often adhere to the plant, even without flaring, until the larva is more than one-third grown.

A profuse shedding of squares is frequently an indication of boll weevil damage. As is well-known, however, certain unfavorable weather conditions often cause the plant to freely shed squares and young bolls, and injury to the squares by any insect will cause them to flare and drop. If freshly-fallen squares and forms be cut open with a knife, it can be readily determined whether or not boll weevil work is responsible. If the fallen squares show no external signs of insect work and their interiors are found to be fresh and not discolored, it can be safely concluded that their dropping has been due to "natural shedding" by the plants. If insect injury is noted, somewhat closer obser-

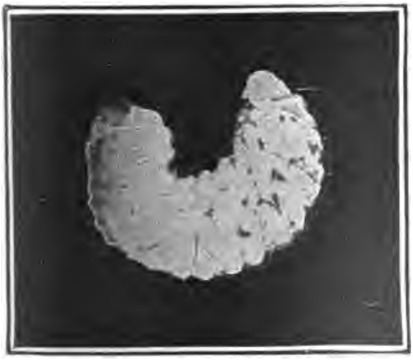

FIG. 8.—Boll weevil larva, much enlarged. (After a photograph by E. Dwight Sanderson).

vation is necessary to determine whether the injury is by boll weevil larvae or by other insects. The boll weevil larva is devoid of legs, while both the cotton-square borer and the boll worm, which are the larvae most frequently mistaken for boll weevil larvae, have well-developed legs. When a white footless grub is found within a fallen square having no external sign of injury (with the exception of the egg-puncture, which is closed) one is fairly safe in assuming that the specimen under observation is a boll weevil larva.

During growth the larva sheds its skin two or three times and when fully grown is about three-tenths of an inch in length and occupies practically all of the space within the square. The larval stage, while the square is lying upon the ground, is perhaps the most critical period for the weevil in all of its life-history. If the square be in direct sunshine and if the weather be dry and hot the larva within it is oftentimes killed by the heat. In the dryer regions of Texas this mortality during the summer months is often so high that the weevil damage is greatly reduced, and the making of good crops of cotton in Texas in 1905 was largely ascribed by the planters to the prevalence of very hot and dry weather during July and August of that year, which resulted in large numbers of the weevil larvae perishing. Where there is plenty of rainfall, or where the plants are rank-growing, affording shade to the fallen squares on alluvial lands already moist, this mortality is small and the majority of the larvae reach matruity.

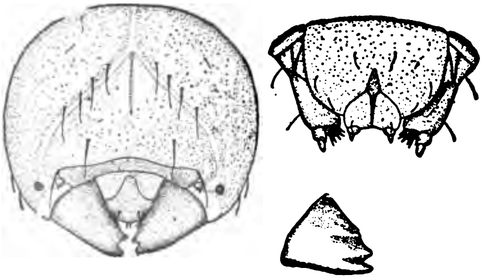

Fig. 9.—Head and mouth-parts of boll weevil larva. (After original drawing by E. C. Sanborn).

The dropping of the infested squares, before the larvae within them reach maturity, early in the history of the weevil fight suggested the picking up of these squares and burning them. There is no gainsaying the fact that the measure is an effective one—so far as it concerns the particular weevil larva that is picked up and burned with the square. The rate of weevil increase is, however, so great that the farmer who tries to follow the plan for any great length of time soon finds that his outlay for the labor required will more than consume any possible profits to be derived from the crop. Where the farmer has a small cotton patch and is so fortunate as to have a large family of children, so that no cash outlay for labor is required, the plan of collecting the fallen squares works admirably and doubtless profitably. The method at best can result in no more than delaying the date of "maximum infestation." This of course means a few more pounds of cotton, but where it is necessary to employ extra labor to pick up the squares there is little doubt that the cost of these few extra pounds of lint considerably exceeds their value.

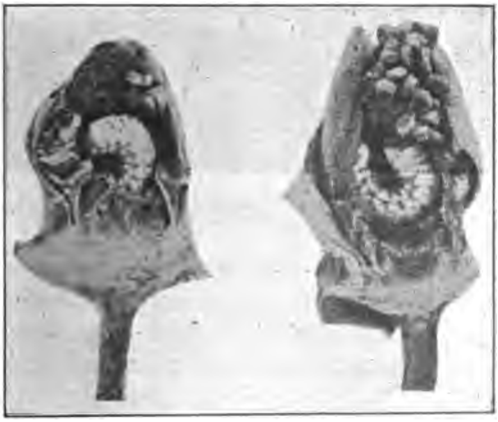

FIG. 10.—Boll weevil larvae within cotton squares. (After a photograph by E. Dwight Sanderson).

On Texas plantations, where hand-picking of the fallen squares was quite generally practiced during the first two or three years of weevil infestation, it has been entirely abandoned.

The larval stage, like the egg stage, varies in length according to the temperature. During July and August the larva reaches maturity in from 6 to 8 days. This period is lengthened as the season advances until in late autumn the larval development may require as much as 3 or 4 weeks.

THE PUPA.

After completing its larval growth the "grub" transforms to the pupa, still within the square. During the pupal stage no food is taken and during this stage also, the first indications of the legs and wings are seen. The appearance of the pupa is well illustrated by Figure 11.

The pupal stage varies from 2 to 4 days in mid-summer, to as much as 15 to 20 days in late autumn, becoming gradually longer as cool weather approaches. The pupa in turn changes into the adult boll weevil which, with its mandibles, eats a hole through the exterior of the square and emerges to the outside world, its growth completed. Upon first reaching maturity the weevil is soft-bodied and of a yellowish or reddish-yellow color but after feeding the body rapidly hardens and assumes a grayish appearance. A weevil emerging from the square in which it developed is shown in Figure 13, and empty squares within which boll weevils have developed are shown in Figure 12.

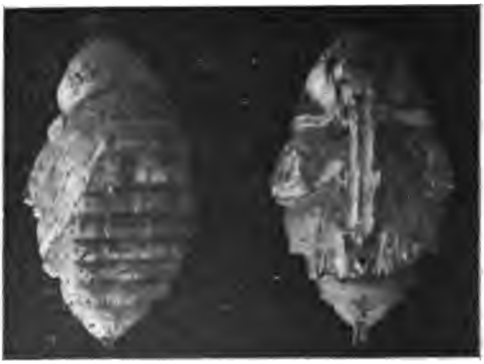

FIG. 11.—Boll weevil pupae. (After a photograph by E. Dwight Sanderson).

The empty squares, from which weevils have emerged, are often confused with squares which have been eaten into by the cotton-square borer or the bollworm. A close examination of a square from which a boll weevil has emerged will show that its interior has been entirely eaten out, and after the weevil's emergence the inside of the square is dark-brown in color and contains more or less of the larval castings. Squares that have been attacked by the square-borer or the bollworm have usually only a portion of their interiors destroyed. The boll weevil when emerging from the square nearly always makes its opening near the top or upper part of the square, while both the bollworm and the square-borer usually make their attacks by eating into the square or form near the base.

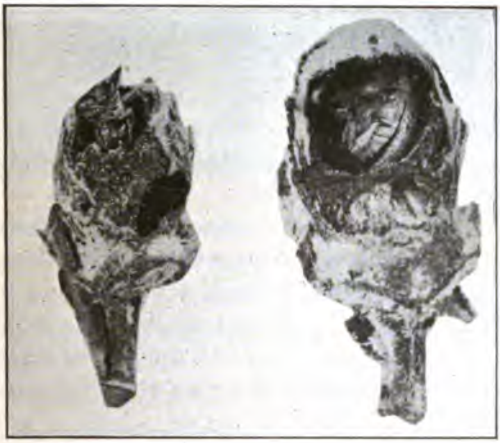

FIG. 12.—Boll weevils inside of the squares in which they developed. (After a photograph by E. Dwight Sanderson).

SUMMARY OF LIFE HISTORY.

Summing up the life-history, we see that the development of the individual boll weevil, from the time the egg is deposited in the square or boll until the adult emerges, requires in July and August from 12 to 15 days, and this period becomes longer and longer during autumn until in November and December 45 to 50 days may be required. If to the period of development proper we add the 5 or 6 days which elapse between the time the weevil reaches maturity and the beginning of egg-deposition we will have from 17 to 21 days as the time required in midsummer for each "generation." As a matter of fact there are no distinct broods or generations, as that term is commonly understood, for the reason that the first developing weevils of early summer reach maturity and commence depositing eggs before the last of the hibernated weevils have finished egg-deposition, or in fact before all of the hibernating weevils have even left their winter quarters. The present season, the first adults began to mature in the vicinity of Keachie about June 20 or 21 and a few hibernated stragglers made their appearance from winter quarters as late as June 27 and 28.*

RATE OF INCREASE.

Although it is not possible to distinguish separate broods of the weevil throughout the season, it will at once be seen from the above facts that the increase is at a geometrical ratio. For the purpose of computing the number of weevils that may result during the season as the possible progeny of a single pair of hibernated adults, the average time of adults becoming mature may be used. A conservative estimate of this increase has been made by Hunter and Hinds,† based, not upon the minimum time required for the egg to hatch and the larva to reach maturity, but upon the maximum time required during the summer months, and also taking into account the time elapsing between arrival of the weevils at maturity and the deposition of eggs by them. Assuming that the average time at which maturity is reached by the first weevils of the season is approximately June 29—and this, according to the writer's observation, is very nearly the correct date for Louisiana—Messrs. Hunter and Hinds find that the progeny of the pair of hibernated adults will at this date be 100. The progeny of this 100 (averaging adult June 29) will amount by the middle of August to 5,000. The descendents of these, becoming adult, on an average, the third week in September will number a full 250,000 provided that a sufficient number of squares and young bolls are present in the fields during this entire time to permit the weevils increasing to the limit of their reproductive ability.

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*These weevils emerged in the large "hibernation cages," from which all emerging weevils had been removed daily for several weeks previous, hence there can be no doubt that these weevils, emerging on June 27 and 28, were coming out of their winter quarters for the first time.

†Bulletin No. 51, Bureau of Entomology, p. 97.

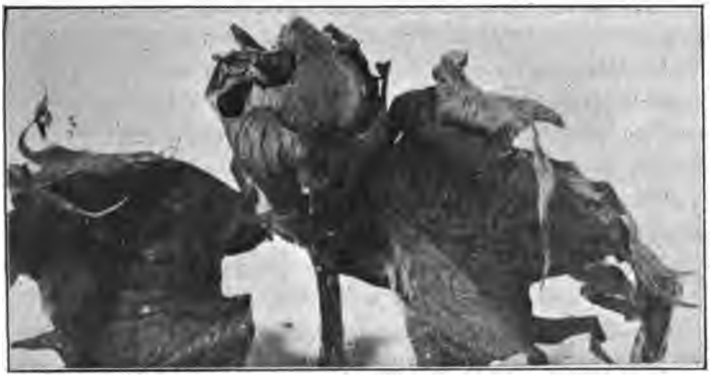

FIG. 13.—Adult boll weevil emerging from square in which it has developed. (After a photograph by E. Dwight Sanderson).

In reality a state of "maximum infestation" (an infestation so heavy that practically all squares are destroyed by the weevils before they have an opportunity to bloom and set bolls) is reached about the middle or latter part of August and the formation of bolls from that time on becomes impossible.

After maximum infestation is reached, the increase of the weevils, for the balance of the season, is limited only by the rate at which the cotton plants produce squares for the weevils to feed upon and for the females to deposit eggs in. Were the cotton plants to keep pace in the production of squares, with the natural demands of the weevils for them, the progeny of one pair of hibernated weevils would by the following winter amount to no less than 15,000,000 individuals.

DISSEMINATION.

The means by which the boll weevil is disseminated from one locality to another and by which it reaches new territory may be conveniently considered under two heads, artificial dissemination and natural dissemination. The first includes the transportation of the weevils in seed-cotton, in cotton seed and hulls and possibly with other materials carried or shipped from one point to another. On the other hand, the movement of the weevils by flight, their carriage by winds or storms and their transportation by floods are among the principal means of natural dissemination.

Artificial dissemination of the weevil can be entirely prevented, whereas the natural dissemination cannot be by any methods that have yet been devised. The laws governing the so-called migratory movements of the pest are evidently as immutable as are other natural laws. A still more important consideration is that while natural dissemination is rarely responsible for the area of infestation being extended more than a few miles at a time, the pest may, through artificial channels, quickly reach localities many miles from the original infested section. From a practical and economic standpoint, therefore, artificial dissemination is of more importance and more deserving of careful attention than are the means of natural dissemination.

DISTRIBUTION IN SEED AND HULLS.

During the cotton picking season many weevils are picked with the seed-cotton and carried to the gin. Many of these are adults, while still others are larvae or pupae in cells within the seed-cotton itself. Most of the machinery in use in the ginneries will not destroy more than a small per cent of the weevils which may be brought in with the seed-cotton. It is therefore readily seen that the transportation of seed-cotton, or of cotton seed, from an infested section to a non-infested section is very likely to result in live weevils being carried to the latter, there resulting in infestation of the cotton fields. Repeated examinations of the seed-houses at ginneries in the boll weevil sections have revealed the presence of live weevils in the seed, and cotton seed being shipped from weevil-infested sections has by actual examination been found to contain the live boll weevils.*

The weevils are also disseminated in hulls from oil mills. The seed which comes from the infested sections to the mill contains the weevils both in the adult stage and in pupal cells closely resembling the seeds themselves,† and although the hullers commonly in use in the oil mills will destroy all boll weevils passing through them with the seed, the hulls after crushing are usually exposed to re-infestation in the open conveyors and in the hull storage rooms. The latter rooms are often no more than open sheds and during the autumn there is no obstacle whatever to adult weevils entering them from neighboring infested fields when seeking hibernating quarters. Weevils can also enter the hulls when coming from infested seed still uncrushed, the latter often being kept in the same building or compartment with the hulls. Early in 1905 the Commission devised a method of arranging the oil mill machinery whereby the hulls are completely protected from re-infestation after leaving the huller until they are in the closed box cars ready for shipment. Several of the oil mills located in the weevil section of the State have adopted this arrangement and handle their hulls in accordance with the instructions of the Commission. Such mills receive permits allowing the shipment of their hulls to the non-infested sections of Louisiana. The shipment of hulls to the non-infested section by mills which do not handle their hulls under these precautions is prohibited.

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*Tabulated results of such examinations will be found upon page 125 of Bulletin 51, Bureau of Entomology, U. S. Dept. of Agriculture.

†For full description of these pupal cells see Bulletin 51, Bureau of Entomology, page 37.

Since the discovery of the migratory habit of the boll weevil in 1904, many people have thoughtlessly ignored the importance of preventing dissemination of the weevil in hulls and seed. It is significant that had it not been for the artificial dissemination of the boll weevil, Louisiana and Texas would probably not have this pest to contend with at the present time. "No more striking instance of the carriage of weevils in seed-cotton could be given than that by which the weevil was originally carried from the Brownsville region across a stretch of non-cotton producing country nearly one hundred miles in breadth to Alice (Texas), where the cotton was taken for ginning in 1893 and 1894. But for this assistance the invasion of the principal cotton-growing area of Texas might have been for many years delayed."*

Prior to the enforcement of quarantine regulations by the State Crop Pest Commission, many cases of isolated infestation occurred in the western parishes of the State, most of them being directly traceable to the bringing of seed-cotton or cotton seed from the infested sections of Texas. Since the Commission's quarantine regulations, which prohibit the movement of seed-cotton, hulls and cotton seed from the infested to the non-infested sections, have been in force, not a single isolated outbreak of the

*Bulletin 51, Bureau of Entomology, page 125.

boll weevil has been discovered and all of the northeastern and eastern portion of the State is, fortunately, still free from this pest. By means of this quarantine artificial dissemination of the weevil in Louisiana has been practically an impossibility and the spread of the pest into new territory has been limited to actual flight. Had it not been for the protection thus afforded eastern Louisiana there is little doubt that the most of Louisiana's cotton-producing territory would now be infested, instead of the pest being confined entirely to the western parishes.

MIGRATION

At or about the time that a condition of maximum infestation is reached in the infested cotton fields, the so-called "migratory habit" of the boll weevil manifests itself. At this time countless numbers of the weevils fly to other localities and into new territory.

To Prof. H. A. Morgan, formerly Entomologist of the Crop Pest Commission, belongs the credit of discovering this habit of the insect. In August of 1904 Prof. Morgan found that the adult weevils were appearing in new localities from ten to fifteen miles from where they had previously been known. Their simultaneous appearance over a large area suggested to him their having reached these new neighborhoods by flight from the heavily-infested fields of Texas. Further investigations in the summer of 1904, by Prof. Morgan and the special field agents of the Bureau of Entomology, then co-operating with the Commission in its campaign against the weevil, resulted in the accumulation of facts which proved conclusively the existence of a wide-spread and extensive movement into new territory by the weevil during the summer and autumn months.

There are still many points relative to this migratory movement of the adult weevils which are by no means clear, but on account of this movement of the pest having been noticed to commence in 1904 and 1905 at about the time that a state of maximum infestation was reached in the infested section, it appears altogether probable that this movement is induced, or at least accelerated, by an insufficiency of uninfested squares. The migration seems to be the following out of a natural inclination on the part of the insects to seek for new and uninfested territory at a time when the fields already occupied by the pest offer insufficient breeding facilities to accommodate its natural rate of increase.

The field observations made during 1904 not only established the existence of this migratory habit, but they also determined the limits of the territory thus occupied by the pest.

To obtain additional information, rather elaborate plans were made for studying the 1905 migrations, but the yellow fever quarantines of August and September, 1905, prevented effective field work of this kind.

The migratory movement of the weevils can hardly be a definite flight in the direction of uninfested fields only. It is much more probable that the flight is an aimless one on the part of each weevil. As those individuals which, at the end of their flight, happen to arrive in a field already infested lose their identity, it is only the weevils arriving in new and previously uninfested territory that can be detected with certainty and recognized as migrating weevils. With countless thousands of weevils flying in every direction, often for many miles, some of them must of course pass over the edges of the infested section and thus extend its limits. This view received confirmation by observations made during September, 1905, when the writer had

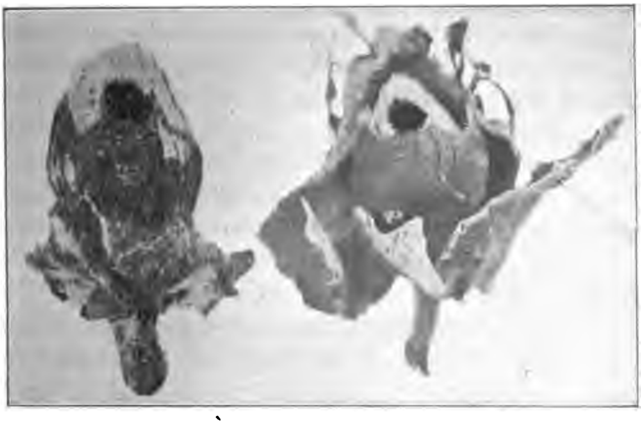

FIG. 14.—Empty squares from which adult boll weevils have emerged after reaching maturity. (After a photograph by E. Dwight Sanderson).

an opportunity to observe the gradual movement of the weevils into new territory during a period of several days duration. Although the accepted opinion is that the weevil in its movement through Texas and Louisiana moves generally towards the north and northeast, the insects were in this case clearly moving to the southeast, and their line of movement, if followed backwards, would have brought one by the most direct route to the nearest heavily infested locality.

The use of the term "migration" in referring to this peculiar and highly interesting habit of the insect is not above criticism, for certain it is that the migrations of the boll weevil are in many ways different from the migrations of birds, and in some respects very different from the migrations of other insects. In the literature available to the writer there is no migratory insect movement described which, even in the most important respects, corresponds with it. The migratory movements of the Rocky Mountain Locust, swarms of which in former years occasionally devastated different sections from Texas to Canada, are perhaps the best known of the insect migrations that have been observed in this country. The locusts in their migrations moved n large swarms, usually in a definite direction and the swarm, rather than the individual, was the unit of movement and action. In the case of the boll weevil there is no apparent tendency on the part of the migrating adults to associate with each other, and the migratory movement is made independently by each individual weevil. The migration of weevils over large areas and involving countless numbers of individuals indicates the existence of some immediate exciting cause which determines the day or week of the movement, but this influence, whatever t may be, does not appear to bring about a movement in any definite direction. On the contrary each weevil appears to decide for itself what direction shall be taken. Nor does the "exciting influence" appear to affect all of the mature egg laying weevils in the fields as the data thus far collected does not show any great decrease in the number of weevils present in the original nfested area at the time these migrations occur.

Upon the relaxation of the quarantine in October, 1905, the assistant entomologists commenced field observations, and a considerable number of records were made which established the fact that the migration is not a daily continuous movement but that marked, distinct migrations, several days apart, occur.

In making these observations, each assistant, when examining a recently infested cotton field, made careful record of its location, the date of inspection and of the different stages of the weevil found to be present.

Fairly complete observations were thus obtained upon 37 instances of migratory infestation. From the above records, and having at hand the temperature records of the Louisiana Section of the U. S. Weather Bureau for various western Louisiana stations, Mr. W. O. Martin, Assistant Entomologist of the Commission, devised a most ingenious method of determining the time of arrival of the migratory female weevils in these infested fields.

Messrs. Hunter and Hinds had previously published n Bulletin 51 of the Bureau of Entomology, the results of their extended observations upon the effective temperature* required for the development of the boll weevil in its different stages.

From their results the following were adopted as the most probable average effective temperatures for the period between September 1st and December 1st: degrees F. necessary for incubation of the boll weevil egg, 136; for development of the larva, 315.6; for development of pupa, 182.6, or for complete development, 634.2.

In determining the date of earliest infestation, Mr. Martin first noted from the field records the oldest stage of the weevil present when the infestation was discovered, such for example as one-fourth grown larvae, half-grown larvae, matured pupae, etc. The effective temperature necessary to bring about the development of this stage was then ascertained. In the case of

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*"In considering the influence of temperature upon the weevils it has been found that with the weevil, as has been found to be the case with many animals, 43 degrees F. is about the lowest temperature at which activity is shown. Temperatures below that point would, therefore, have no influence upon activity, while all above that point would. For this reason, it is better to speak of the 'effective temperature,' meaning by that the number of degrees above 43 degrees F. Experiments made upon the influence of temperature upon the activity of weevils indicate that this is an approximately correct figure for this insect." —Bulletin 51, Bureau of Entomology.

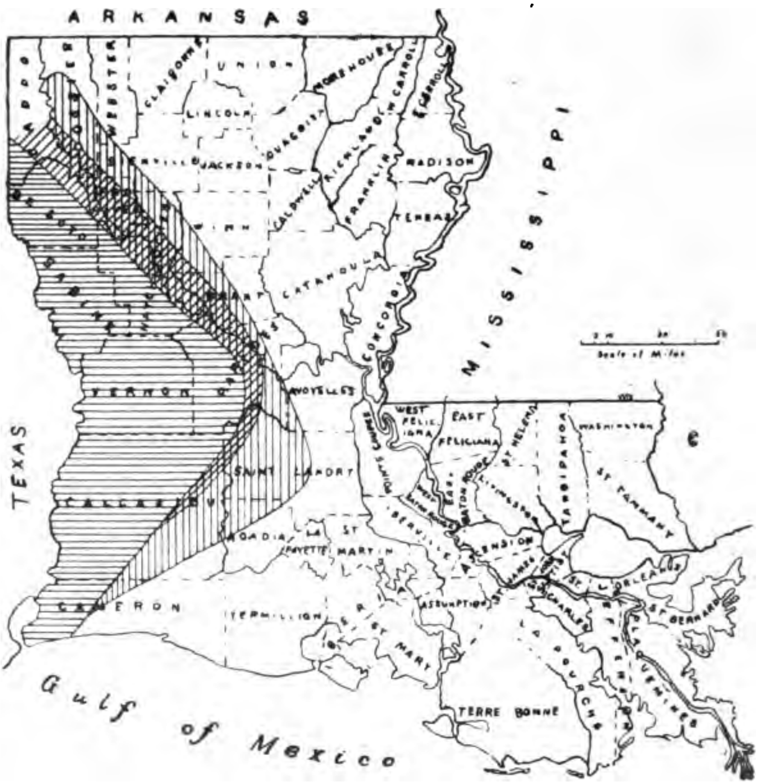

FIG. 15.—Map showing migrations of boll weevil in Louisiana during October, 1905. Area shaded with horizontal lines is that which was occupied by the weevil prior to, and upon October 1, 1905; that shaded with slanting lines is the area occupied by migration of October 4-8, and that shaded with vertical lines is the area occupied by migration of October 14-18.*

half-grown larvae this would be 293.8 degrees F. (136 plus one-half of 315.6). The temperature records kept at the nearest Weather Bureau observing station were then consulted and the daily mean temperatures determined for a number of days prior to the date upon which the infestation was discovered. From the daily mean for each day 43 was substracted, and the remainders then added (proceeding chronologically backwards) until the aggregate sum of these effective temperatures equaled or exceeded the number of degrees necessary for development from the egg to the particular stage found upon the date of inspection. The date upon which these two sums became equal, or upon which the former became greatest, must necessarily have been the date upon which the egg was deposited, and presumably the migrating female arrived in the field not more than a few hours previous to the deposition of the egg. The following, which was one of the 37 "computations" made in this manner, will serve to illustrate the method:

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*Owing to the limited time for field examinations allowed by quarantines, actual examination of fields in Acadia Parish were not made, but the location of known infestations in St. Landry and Calcasieu Parishes indicates the very probable occurrence of the weevil in northwestern Acadia Parish and it is accordingly so represented on this map.

Parish: St. Landry.

Town: Bayou Chicot.

Exact location of field: 1 mile east of Bayou Chicot.

Date of inspection: Nov. 2, 1905.

Oldest stage of weevil found: half-grown larva.

Nearest Weather Bureau Observing Station: Opelousas.

Effective temperature for development of egg	136.0°
Effective temperature for development of half-grown larva	157.8°
Total effective temperature for development of stage found	293.8°

The daily mean and effective temperatures at Opelousas had been as follows:

DATE	Nov. 2	Nov. 1	Oct. 31	Oct. 30	Oct. 29	Oct. 28	Oct. 27	Oct. 26	Oct. 25	Oct. 24	Oct. 23	Oct. 22	Oct. 21	Oct. 20	Oct. 19	Oct. 18
Mean, deg. F.	56	57	63	71	58	59	57	63	70	60	57	55	54	76	80	80
Constant, (subtracted)	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
Effective, deg. F.	13	14	20	28	15	16	14	20	27	17	14	12	11	33	37	37

By adding together the number of degrees of effective temperature thus determined (13° plus 14° plus 20°, etc.,) we find that from October 18 to November 2, inclusive, a total of 328°

of effective temperature had accumulated, or a trifle more than enough to bring about the hatching of the egg and the development of the half-grown larva. The egg must therefore have been deposited on October 18, and as a long series of observations strongly indicates that the migratory female insect wastes little, if any, time after arriving in a field before depositing eggs, the date of egg deposition as determined above must be practically the date of arrival of the migratory female.

Despite the fact that the field examinations had been made by the different assistants without particular attention being paid to the exact age of the oldest stage of the weevil present, the application of this method gave surprising results. In the case of almost every infested field it was found that the first eggs had been deposited either between October 4 and 8 or between October 14 and 18, thereby indicating that there had been two marked and distinct migrations, one occurring between October 4 and 8 (averaging October 6), and the other between October 14 and 18, (averaging October 17). Nor did the figures and dates obtained indicate any migration, during October or November, other than these two.

The area occupied by the weevil in each of these migrations is shown in Figure 15. It will be noted that over a considerable territory the two migrations over-lapped. Within this area eggs were deposited by females coming with both migrations, and in fields within this common area it was not difficult to distinguish the two different sizes of larvae resulting from these two migratory infestations.

The eggs deposited between October 14 and 18 could not have been deposited by the progeny of weevils arriving in the fields between October 4 and 8, as at the temperature then prevailing an egg deposited as early as October 4 could not have produced matured weevils, ready for egg-deposition, earlier than November 4th.

It is of course conceivable that the weevils which deposited eggs between October 4 and 8 might also have deposited eggs between the 14th and 18th. In the area covered by the October 14-18 migration only, this was of course impossible, and the existence of the latter migration was thereby firmly established.

Knowing that such a migration had taken place it was comparatively easy to distinguish the individuals resulting from it in the area covered by both migrations.

Owing to the comparatively short time allowed for field work after the relaxing of quarantines, about October 15th, and the first autumn frosts it was not possible to thoroughly study conditions in all of the suspicioned territory. The areas shown on the map (Fig. 15) are not complete for the extreme northern part of the State, but are approximately correct for all the territory from Shreveport as far south as Acadia parish.

HIBERNATION.

The winter is passed by the boll weevil in the adult stage. In extreme South Texas during mild winters some of the larvae and pupae slowly develop in the bolls, or the late-developed adults successfully survive the winter in the bolls in which they matured. In Louisiana, however, it may be safely stated that this does not occur. During the winter of 1904-'05 examinations were made during January and February, in infested cotton fields, but in no case were living larvae, pupae or adults found in the infested bolls. The winter of 1905-'06 was much milder than the preceding one and the field examinations showed the presence of living larvae and pupae in the frost-killed bolls early in January. By the first week in February only one larva or adult out of several dozen in the bolls was found alive, and after the middle of February no live weevils in any stage were found in these situations.

The adults enter hibernation at, approximately, the time of the first hard killing frosts. Although it has been supposed that the weevils commence seeking hibernating quarters when the daily mean temperature falls to 60° or slightly below* the weevils under observation at Keachie in the fall of 1905 showed no tendency whatever to seek hibernating quarters until December 8th, although the average daily mean temperature for the ten days preceding December 8th was but 43°, and for five days preceding was 41.7°†

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*Hunter and Hinds, Bul. 51, Bur. of Entomology, p. 103.

†Records of U. S. Weather Bureau Station at Shreveport, 23 miles northeast of Keachie.

The adult weevils enter various situations which will afford them protection through the winter. Many remain in the cotton fields, especially if the latter be grassy and covered with considerable vegetation. Leaves and grass afford excellent hibernating quarters and ditch banks and headlands present conditions favorable to the survival of many weevils, especially if the field be high and well-drained. The forests and timber lands adjoining cotton fields afford good hibernating places, as is evidenced by the fact that in cotton fields the heaviest infestation in spring is usually next to the timber and grows less as the distance from timber becomes greater. Painstaking examinations of the leaves and trash in the timber, during the winter months, reveal the presence of the hibernating weevils, so that there can be no question as to their passing the winter in such situations. Their appearance in spring next to the timber, as they come from hibernation, has at times created the impression that they "raise in the woods," an idea which is entirely erroneous.

The percentage of adult weevils surviving the winter has been variously reported as being from 2 to 25 per cent. In the case of 25,800 boll weevils kept under observation in the large experimental cages at Keachie during the winter of 1905-'06, less than 3 per cent survived,* and yet the present year's infestation in DeSoto Parish is heavier than the writer has ever seen anywhere. The observations at Keachie, which were perhaps as extensive and complete as any observations of the kind ever made, may be considered as indicating the number of boll weevils surviving a mild winter in North Louisiana. A winter such as that of 1904-'05 would hardly permit a survival of more than one per cent of the adults which enter hibernation in the fall.

The emergence of the adults from their winter quarters is exceedingly erratic and irregular. At Keachie the first adults made their appearance March 22nd, long before any cotton was above ground, and some of them went back into their winter quarters to emerge again a few days later. Weevils continued to emerge in varying numbers all through April and May and early June, the last one appearing upon June 28th. The date of maximum emergence was April 28th, but for a few days between May 12 and 21 the weevils appeared from their winter quarters at a higher average daily rate than they did late in April. As these observations upon the hibernation of the weevils at Keachie will be referred to more in detail in some future publication, detailed discussion will not be given them at this point.

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*The exact percentage of weevils surviving was 2.86.

Upon leaving their winter quarters the adults begin an active search for growing cotton. It has been commonly supposed that the hibernated adults, and the adults of the first summer generation do not fly far from the point where the winter was passed, especially as long as plenty of uninfested squares are available. Observations made in Sabine Parish in the spring of 1905, on an area several miles in extent, where no cotton had been grown the previous year, showed that the weevils travel comparatively rapidly from one field to another. In this case the weevils spread into previously uninfested territory to a distance of two miles or more between June 16 and July 8th. In this case the movement of the weevils was from one cotton field to another, and in the event of the weevils not finding green cotton readily upon emerging from hibernation it seems probable that they would travel much greater distances than this in search of it.

Louisiana State University and Agricultural and Mechanical College,

BATON ROUGE, LA.

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Tuition is free to all residents of Louisiana, and living expenses are as low as at any other institution of the same grade.

For further information or catalogue, address

J. L. WESTBROOK,
Secretary.

Baton Rouge, La., July, 1906.

SPECIAL NOTICE

Regarding the Publications of the State Crop Pest Commission.

The work of the State Crop Pest Commission consists of enacting and enforcing quarantine regulations to prevent the introduction of dangerous insects into Louisiana, of preventing the dissemination of serious insect pests from point to point within the State, and of investigating insect enemies and devising remedies therefor.

The inspectors employed by the Commission annually inspect every nursery in the State, and also inspect thousands of trees shipped in from other States, confiscating all diseased and infested stock and thereby protecting the fruit growers and farmers against a host of dangerous insects and diseases. No fruit trees or other nursery stock can be legally sold in Louisiana without being accompanied by an official certificate of inspection.

The Commission answers, *free of charge*, inquiries concerning injurious insects and the methods to be used in controlling them. Upwards of 2,000 farmers, planters and fruit growers of the State now avail themselves of this privilege.

The Commission publishes, from time to time, Circulars dealing with different insects of importance, and the means of subduing them. These circulars are sent FREE, until editions are exhausted, to all citizens of Louisiana who request them. The following Circulars, now available for distribution, are of present interest and importance:

Circular No. 4.—"The San Jose Scale." This serious insect pest of fruit trees, which has already obtained a start in many parts of the State, is described in this Circular and means of fully controlling it are given. The spraying formulae, etc., are so simple that any person of average intelligence can, with the assistance of this Circular, fully control this dreaded pest.

Circular No. 6.—This Circular is upon "The Horseflies of Louisiana, with A Discussion of Remedies and Natural Enemies."

A number of Circulars, dealing with different aspects of the BOLL WEEVIL PROBLEM and giving important facts brought to light by the recent investigations of the Commission and recommending measures of control based thereon will be issued before the end of the year.

If you wish to receive future Circulars of the Commission, do not fail to AT ONCE write to the Secretary, asking that your name be placed on the Commission's mailing list. As the last Legislature made no appropriation for the work of the Commission, the EDITIONS OF ALL CIRCULARS WILL BE LIMITED, and when the names upon the mailing list equal the number of copies which the Commission can afford to publish, subsequent applications will have to be refused.

Wilmon Newell, Secretary,

Box 620. Baton Rouge, La.

B824

CIRCULAR NO. 10

OF THE

State Crop Pest Commission

OF

LOUISIANA.

THE CATTLE TICK.

Studies of the Egg and Seed Tick Stages. A Simple Method of Eradicating the Tick.

BY

WILMON NEWELL AND M. S. DOUGHERTY.

Issued Under the Direction of the State Board of Agriculture and Immigration.

CHAS. SCHULER, Commissioner.

BATON ROUGE, LA.
THE TIMES PUBLISHING COMPANY.
1906.

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STATE CROP PEST COMMISSION OF LOUISIANA.

ORGANIZATION.

HON. NEWTON C. BLANCHARD, Governor of Louisiana.

HON. CHAS. SCHULER, Commissioner of Agriculture.

PROF. W. R. DODSON, Director, State Experiment Stations.

WILMON NEWELL, Entomologist, State Experiment Stations.

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C. W. FLYNN, Assistant Entomologist, Boll Weevil Investigations.

HARPER DEAN, JR., Assistant Entomologist, Miscellaneous Investigations.

MALCOLM S. DOUGHERTY, Assistant Entomologist, Cattle Tick Investigations.

ARTHUR H. ROSENFELD, Assistant Entomologist, Nursery and Orchard Inspection.

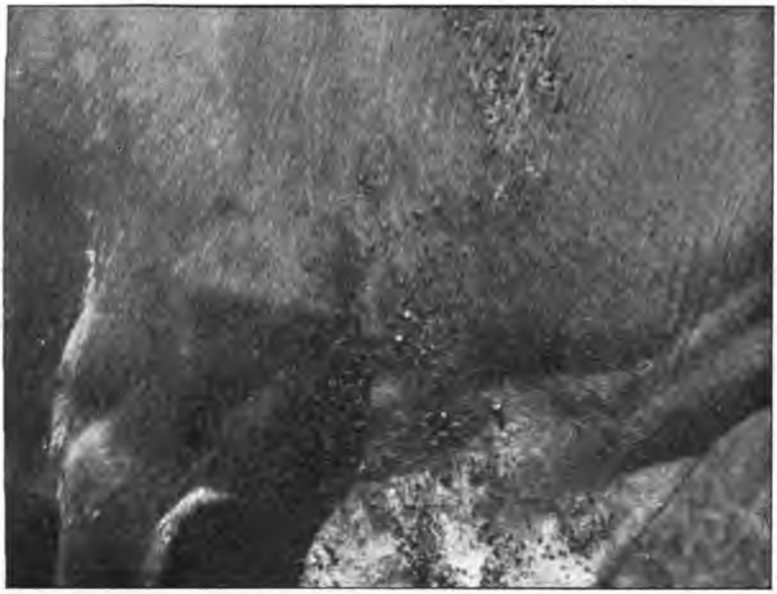

FIG. 1. Ticks of various ages on the brisket of a cow (original).

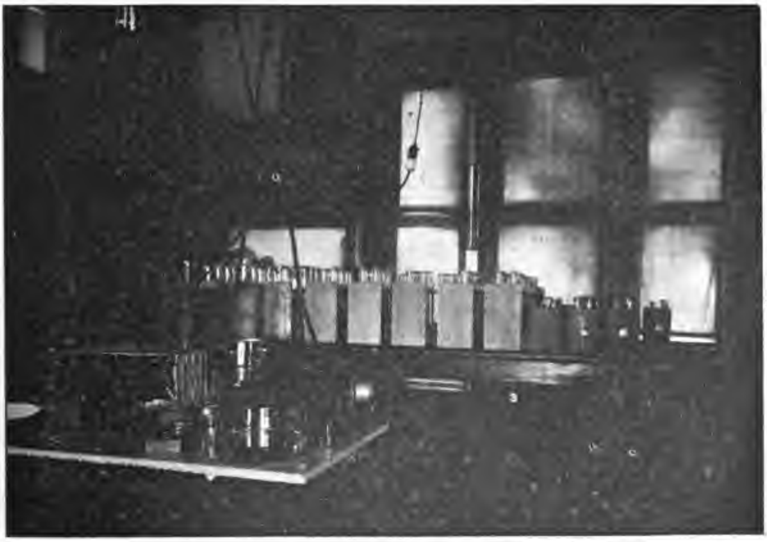

FIG. 2. Tick laboratory, showing tubes containing the 42,751 seed ticks which were used in the experiments described on the following pages.

State Crop Pest Commission
OF LOUISIANA.

CIRCULAR No. 10. November, 1906.

The Circulars of the State Crop Pest Commission are sent free of charge to all farmers and fruit growers of Louisiana who make application therefor.

THE CATTLE TICK.

(*Boophilus annulatus.*)

STUDIES OF THE EGG AND SEED TICK STAGES.
A SIMPLE METHOD OF ERADICATING THE TICK.

By WILMON NEWELL and M. S. DOUGHERTY.

INTRODUCTION.

The most progressive farmers and planters of Louisiana realize that a radical change must take place in the system of agricultural practice which has long prevailed in the State, that a one-crop system must be succeeded by a diversified agriculture, which will not only yield greater and varied returns, but which will at the same time conserve the natural fertility of the soil.

The farmer who has grown cotton to the exclusion of other crops has long been sending away from his farm, in the seed, those elements of plant food which constitute his capital stock. No plant food has been returned to his soils, barring only that in the commercial fertilizers and cotton seed used, and the small amount of nitrogen gathered and stored by occasional patches of cowpeas—all combined being but a mere pittance compared to the plant food taken away from the farm with each cotton crop. The farmer can no more afford, as a business proposition, to sell the elements of fertility, without getting an equivalent amount of plant food in return, which constitute his working capital, than can the banker afford to pay dividends out of the capital stock of his bank. The final result is the same in either case; bankruptcy.

So long as a one-crop system is persisted in, the soils of Louisiana will continue to become each year poorer and less productive. The natural fertility of the soil will never be restored by the mere application of commercial fertilizers, and even were it possible to so restore it, the process would be far from an economical or profitable one.

A diversified agriculture must come in Louisiana, just as it came long ago in the less fertile States of the North and East and in the older European countries.

The advent of the boll weevil is markedly accelerating the adoption of new methods in Louisiana agriculture, and is relentlessly forcing large planter and "hill farmer" alike into a more scientific and rational way of farming.

That cotton can be profitably grown despite the boll weevil, by the use of early-maturing cottons and thorough cultivation, is readily conceded by all, and indeed the methods advocated by the Crop Pest Commission have this year produced, on upland soil, nearly one bale of cotton to the acre, in defiance of the heaviest boll weevil infestation ever known. Nevertheless, the production of cotton by these methods of necessity requires intensive culture and a fertile soil. Intensive cultivation has been practiced upon very few of the farms in Louisiana in the past and under the conditions now impending a smaller area, in proportion to the labor available, must be devoted to cotton, and the remainder to other crops and to the production of live stock. Every farm must become self-supporting, furnishing all feed stuffs—hay, grain and forage—for its own support and all meat for the consumption of its occupants, leaving the cotton crop as the surplus, always convertible into cash, and unhampered by crop mortgages or unpaid bills for bacon and corn meal at the store of the nearest merchant.

To properly maintain the fertility of the soil, and to maintain maximum production in the case of any and all field crops, live stock is an absolute necessity. The bulk of the plant food which is contained in the forage, grain, cotton seed products, etc., fed to the stock, does not go to the making of meat, but is returned to the soil with the manure. Thus the farmer who markets his beef cattle, pork, or dairy products, unlike the cotton farmer, is not sacrificing his capital stock of soil fertility, but is in reality selling only a product which has been elaborated mainly, as one writer tersely expresses it, "out of wind and water."

Aside from the importance of live stock production as a necessity to continued productivity of our soils, Louisiana offers what are undoubtedly the finest natural advantages in the United States for the production of beef and dairy cattle.

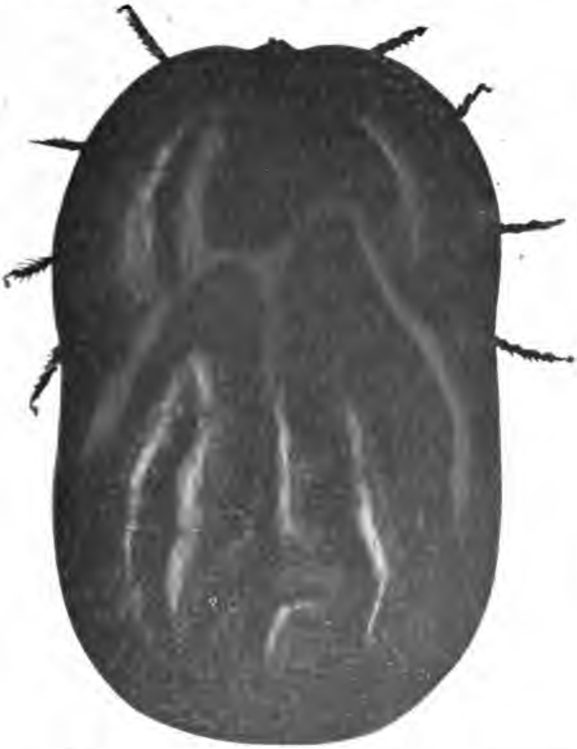

FIG. 3. Fully engorged female cattle tick, as she appears when ready to drop from the cow or steer to the ground to begin laying eggs. Enlarged eight times. (After Mohler, U. S. Dept. of Agriculture.)

The abundant pasturage and forage afforded by our Bermuda grass, white clover, carpet grass, lespedeza and alfalfa fields (in certain sections), together with the cotton seed meal and hulls, cowpeas, molasses and various rice by-products, give us a greater abundance and variety of stock feeds than are available in any other portion of the United States. Only one obstacle stands in the way of Louisiana ranking among the leading beef-producing and dairying states of the Union. That obstacle is the Texas fever cattle tick. Not only a heavy handicap to the production of beef and dairy products, the tick also stands in the way of our farmers adopting a proper rotation of crops.

LOSSES DUE TO THE CATTLE TICK.

The Yearbook of the United States Department of Agriculture for 1904 estimates the annual losses due to the tick, in the Southern States, at approximately $100,000,000.

Mr. August Mayer, the well-known stock breeder of Shreveport, La., has recently pointed out* that the *direct* loss to the South each year, occasioned by the cattle tick, is not less than $46,500,000, this loss consisting of the death of cattle from excessive tick infestation and from Texas fever (for which the tick is in all cases responsible) and the loss in flesh by both beef and dairy cattle due to the drain upon them by the ticks.

In addition to this direct loss, Mr. Mayer also points out that the *indirect* loss occasioned by the greater length of time required for maturing cattle when the tick has to be contended with, and the failure of Southern cattle to even approximate the average valuation of cattle in the tick-free States, amounts to the additional sum of $84,000,000 a year.

The losses chargeable to the presence of the cattle tick in the South may be roughly summed up as follows:

1. Death, from Texas fever, of purebred cattle imported from the North for breeding purposes.
2. Death, from Texas fever, when cattle reared in isolated tick-free areas are unintentionally or accidentally placed with ticky cattle, or on tick-infested areas.
3. Death of native cattle from excessive parasitism and fever, occasioned by the ticks.
4. Universal loss of weight by all tick-infested cattle, and their failure to gain flesh at a rate great enough to make beef production profitable.
5. The lower price which "southern" cattle bring upon the market, regardless of how perfect their condition may be.

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*Farmers' Bulletin No. 261 of the United States Department of Agriculture.

6. Sterility induced in high-grade cattle by tick-infestation.

7. The expense of maintaining the Federal quarantine for the protection of the North against invasion by the tick, and the added expense of maintaining quarantine pens for southern cattle shipped north for slaughter.

8. The discouraging effect on the breeding of pure-bred cattle in the South, by reason of southern breeders not being allowed to exhibit in northern show rings.

9. By no means least, the potential loss in fertility of southern farm lands due to a one-crop system which, with the tick eradicated, would quickly give way to a diversified agriculture which would conserve and increase the fertility of our soils.

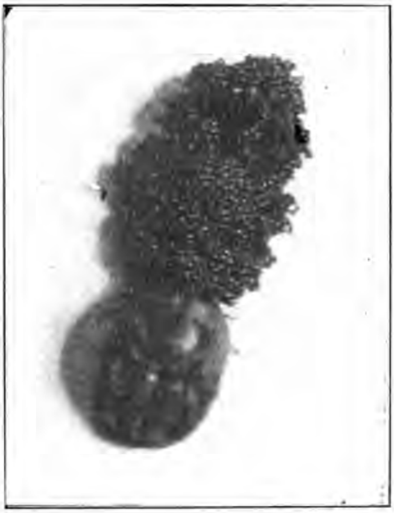

FIG. 4. Adult female cattle tick depositing eggs upon the ground. Twice natural size. (Original photo by Harper Dean, Jr.)

The great drain upon southern agriculture, occasioned by this parasite, and the benefits which would follow its eradication are clearly and forcefully pointed out by Mr. Mayer in his bulletin, which should be secured and read by every farmer in Louisiana.*

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*This bulletin can be obtained free upon application to the Hon. Secretary of Agriculture, Washington, D. C., or upon application to the State Crop Pest Commission, Baton Rouge, La.

Never before, in the history of American agriculture, has it appeared even remotely possible to completely and entirely exterminate any insect or parasitic enemy. The investigations which various entomologists have made of the life history and development of the cattle tick show that its complete and *total* annihilation in the United States is not only a possibility, but an assured fact when the farmers and cattlemen understand that this can be accomplished and when they set to work in steady co-operation with each other and the proper State officials to remove this cursed parasite from the South. The tick has no wings—it cannot escape us by flying—its spread can be completely controlled by controlling the movement of the infested cattle; we know now how to rid the cattle of it and how to free the pastures from it, and once a herd and its pasture are freed of this pest, they can forever afterwards be *kept* free.

No grander opportunity for advancing Louisiana agriculture and prosperity ever presented itself to our farmers than this, the opportunity to exterminate the cattle tick.

THE LIFE HISTORY OF THE CATTLE TICK.

The cattle tick is a parasite and derives its nourishment entirely by sucking blood from the animal (cow, steer, calf or deer, and in rare instances a horse or mule) to which it is attached. (See Figure 1.) The female tick, after having reached maturity, releases her hold upon the animal and drops to the ground. (See Figure 3.) In from two to five days (usually three) after dropping to the ground, the female begins depositing eggs.* (See Figure 4.)

Deposition of eggs is continued (if the weather be warm) for eight to fifteen days, each female depositing between 1,500 and 4,500 eggs during that period. Soon after she has laid her quota of eggs the female dies.

The eggs thus deposited upon the ground† hatch in from seventeen or eighteen to thirty days (in mid-summer) and as soon as they have left the egg-shell the baby ticks, or "seed ticks" (See Figure 5), as they are called, crawl up the nearest weed or blade of grass and bunch together near its top, where they await the passing of the first animal. As soon as a cow or steer brushes against the bunch of seed ticks, or lies down in contact with them, they get upon the animal, select suitable positions, insert their mouth-parts and commence sucking blood. Growth of both males and females from this time on is rapid. Both males and females moult, or shed their skins, twice during growth, the engorgement of the females taking place after the second molt. The male ticks do not become nearly so large as the engorged females, and may be readily mistaken for partly-grown females, or "yearling" ticks, unless close examination is made.

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*The females do not "burst open," and young ticks crawl out of them, as is supposed by some farmers. That the engorged female tick actually lay eggs, as described herein, can easily be verified by taking a few full-grown ticks from a cow and placing them in a glass or cup in a warm room where, in a few days, they will begin laying eggs.

†Eggs are never deposited upon the cow, steer or other animal.

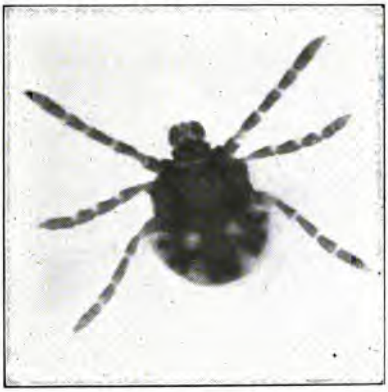

FIG. 5. Seed tick, or baby tick, just hatched from the egg. The seed tick has but six legs, but after growing for awhile the skin is shed and at the time of this first "molt" the tick acquires eight legs. Greatly enlarged. (From a photomicrograph by E. C. Cotton.)

In from twenty-one to forty-five days (depending upon prevailing temperature and the condition of the host animal) after the female seed tick gets upon the animal, her growth is completed and she drops to the ground to deposit eggs. Thus the life-cycle goes on, generation after generation being produced from March until November.

With the coming of cold weather the eggs do not hatch, nor will they hatch until the warm days of spring, although seed ticks which have hatched just prior to the coming on of cold weather, and which are lying on the ground in a semi-dormant condition, may become active during warm spells through the winter.

Ticks which have already attached themselves to the animals, when cool weather sets in, continue to develop and drop from the animals when their growth is completed. The maximum time for completing their growth is, in Louisiana, about forty-five days

When one considers the enormous number of eggs laid by each female, that only a comparatively small per cent fail to hatch, and the rapid development of the growing ticks, it is not at all difficult to understand why our cattle become infested with hundreds of thousands of ticks by the latter part of the summer.

THE RELATION OF THE CATTLE TICK TO TEXAS FEVER.

Texas fever* (also known as splenetic fever, murrain, tick fever, etc.) is the disease which attacks northern-bred animals imported to the South without first having been rendered "immune" by inoculation.

Many cattle, especially in Southern Louisiana, die each year by reason of their having been reared on tick-free areas, as on tick-free cane plantations or city premises, and later placed with ticky animals or on ticky pastures, by which means they become infected with Texas fever.

The disease is caused by a microscopic organism or animal parasite† which lives in the blood and destroys the blood corpuscles of the animal attacked. These germs occur not only in the blood of animals actually having Texas fever, but also in the blood of every bovine animal which has ever had an attack of Texas fever and recovered therefrom (so-called "immune" animals). In sucking blood from the immune or fever-infected animal, the tick secures the germs along with the blood. When the female tick deposits eggs, the germs pass into the eggs and later into the seed-ticks hatching from these eggs.

When these seed-ticks get upon a bovine animal and begin sucking blood, the germs of Texas fever pass from them into the system of the host animal. If this host animal has previously had an attack of Texas fever and is "immune," an attack of fever is not likely to follow, but if, on the contrary, the animal happens to be one which has never had the fever, as for example, a young calf or a cow raised upon a tick-free area, an attack of Texas fever follows within a short time (ten to fourteen days), and this, in the case of cattle one year or more of age, is in most cases fatal.

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*For a full discussion of Texas fever, read Bulletin No. 84 of the Louisiana Experiment Stations, by Dr. W. H. Dalrymple, which can be obtained by addressing Prof. W. R. Dodson, Director, Baton Rouge, La.

†Having the Latin name of *Piroplasma bigeminum.*

The presence of the germ is not necessary to the development and reproduction of the tick, but *the tick is an absolutely necessary agent for the transmission of Texas fever from one animal to another.*

Light attacks of Texas fever may be induced in non-immune animals by injecting into their circulation blood taken from an immune animal, and this process is used in "immunizing" cattle to protect them against attacks of the fever. With this artificial exception, Texas fever cannot be transmitted from one animal to another except by the tick. Hence, were the cattle tick eradicated, there could be no more Texas fever.

We are often told by farmers that, although their farms and cattle are abundantly infested with the ticks, their cattle "have never had Texas fever." This misconception arises from the fact that young calves do not suffer as severely from the fever as do older animals, and calves born upon ticky pastures are invariably infested by the ticks almost immediately after birth, a mild attack of Texas fever following. This light attack, which renders the calf thereafter "immune" is often overlooked entirely by the farmer, or if the calf is so unlucky as to die during the attack, the farmer does not take the trouble to inquire into the cause of its death. All cattle which have been raised on ticky pastures have had Texas fever at some period in their lives.*

It is extremely doubtful if such a thing as absolute immunity to Texas fever exists in any bovine animal, for when the so-called "immune" animals become heavily infested with the ticks and reduced in flesh, an attack of fever often occurs and the ticks and fever combined quickly bring death to the suffering animal.

When it was discovered that partial immunity could be conferred upon animals by inoculating them with blood from native or "immune" animals, many thought that the Texas fever problem had been solved, and an over-confidence in "immunization" resulted in heavy losses to many cattlemen. Now that we know that absolute immunity cannot be obtained, but one method of solving the Texas fever problem remains open to us, and that is by exterminating the cattle tick.

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*Reference is here had solely to the Texas fever cattle tick, and not to the lone star tick or other species of ticks which occur in smaller numbers and which play no part in the transmission of Texas fever.

It is not the object of the present paper to discuss Texas fever, as this is more properly a subject for the veterinarian, and for a further consideration of this phase of the subject the reader is referred to Bulletin 84 of the State Experiment Station, mentioned above, or to one of the United States Department of Agriculture bulletins upon this subject.*

THE MOVEMENT TO ERADICATE THE TICK FROM THE SOUTHERN STATES.

The Bureau of Animal Industry of the United States Department of Agriculture has for a number of years recognized the important role which the cattle tick plays in the transmission of Texas fever, Smith and Kilborne having been the first to recognize and describe the protozoan parasite which is the cause of Texas fever, and which is conveyed from one animal to another by the tick.†

The investigations of Dr. Mark Francis, of Texas, corroborated the discoveries of Smith and Kilborne and added to our knowledge concerning the part played by the tick in transmitting the fever.

Dr. Cooper Curtice, after studying the life history of the tick, was the first to suggest the possibility of exterminating it upon limited areas by a system of rotation. Prof. H. A. Morgan, formerly Entomologist of the Louisiana Experiment Stations, made careful studies of the developmental stages of the tick at different periods of the year and devised therefrom systems of feed-lot and pasture rotations by which both cattle and pastures could be freed of the ticks. This investigation convinced Prof. Morgan that the tick could not only be exterminated on limited areas, but that, by proper co-operation of farmers and cattlemen, it could be entirely eradicated from the Southern States. Largely as a result of his enthusiastic agitation of the

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*See list of bulletins in back part of this Circular.

†Bulletin No. 1, Bureau of Animal Industry.

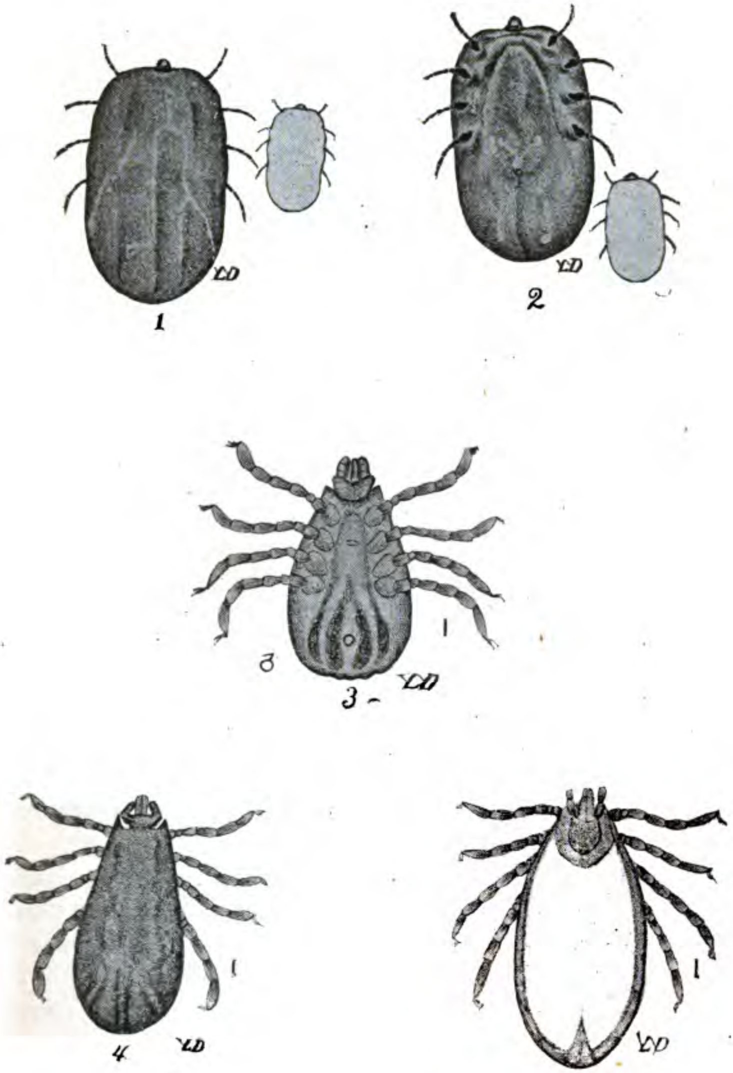

FIG. 6. Male and female cattle ticks: 1, dorsal view of adult engorged female (natural size at right); 2, ventral view of adult engorged female (natural size at right); 3, ventral view of full grown male (greatly enlarged); 4, dorsal view of full grown male (greatly enlarged); 5, tick moulting second time (greatly enlarged). (After Morgan, Bulletin No. 51, Louisiana State University Experiment Stations.)

subject, the Southern Commissioners of Agriculture, at their meeting in Richmond, Va., in November, 1905, adopted resolutions favoring the appropriation of money by the National Congress to aid the Southern States in dealing with this pest. During the session of Congress following, many prominent agriculturists from the South appeared before the House Committee on Agriculture in support of the bill making this appropriation, and the congressmen from the South, especially Hon. Jos. E. Ransdell and Hon. J. P. Watkins of Louisiana, were successful in getting the bill passed, appropriating the sum of $82,500 to be expended by the United States Department of Agriculture in helping the Southern States eradicate the tick.

State Boards of Agriculture, Experiment Stations and other official organizations throughout all of the Southern States, bodies of leading agriculturists and the United States Department of Agriculture are at present working in co-operation with each other, preparing for the greatest warfare ever undertaken against a common enemy. To totally exterminate the tick in the South is indeed an undertaking of enormous magnitude, and it can not be accomplished without years of work and thousands of dollars expended in educating the farmers and cattlemen to the importance of this pest and in the methods by which it may be disposed of. Yet the warfare must be waged and carried to a successful conclusion, in order that the South may be continued in its present condition of prosperity and agricultural supremacy.

The pecuniary benefits which will accrue to every Southern interest in future years as a result of the eradication of the tick, will repay a million-fold all the work and money required to accomplish it.

In North Carolina, in counties adjacent to the Federal quarantine line, the work of eradicating the tick has been going merrily on for several years. The present year, under the direction of Dr. Tait Butler, seven counties have been freed from the tick, and the quarantine line moved to the south of them to prevent their reinfestation. In Tennessee eight counties have been freed of the tick during the last three years, and in Georgia at least two counties have been freed of this pest the past season by similar methods, the tick-*free* area being thus continually extended further and further to the southward.

All of Louisiana is "below" or south of the Federal quarantine line. In other words, practically all of Louisiana is infested by the tick, and it is therefore impossible for us to at present adopt the plan of "pushing the quarantine line south" that has worked so admirably in North Carolina. Yet there are a number of parishes in the State, especially in the cane-growing sections of South Louisiana, where the ticks are not abundant, and a considerable number of plantations doubtless exist which are already free from the tick, either as a result of no cattle being kept on them, or through a fortunate series of "accidents." These can be made neuclei, or centers, as has been pointed out by Morgan, where the work of tick-eradication can begin, and as farm after farm is freed from the ticks, the tick-free area will increase until tick-free parishes are secured. Tick-free parishes, coelescing, in turn will form still larger areas which can be protected from reinfestation by suitable quarantine restrictions, preventing the movement of ticky cattle into them.

Finally, the entire State can be freed of the pest, and as the work continues at the same time in surrounding States, a "tick-free South" will be the final result.

The greatest obstacle to rapid and successful eradication of the tick in Louisiana, is the "free range." Tick-infested animals, in most parishes, roam the swamps, public roads and levees at will, scattering egg-laying ticks everywhere, endangering the man who has eradicated the pest from his own farm, and infesting every public highway so that tick-free animals can not be driven over it without danger of becoming infested.

The free range must go, and there must be enacted laws, or police jury regulations, requiring every man to keep his cattle upon his own premises. That such regulations will meet with opposition goes without saying, but the sacrifice of the "free range" is nothing, when compared to the benefits to be derived from tick-eradication. Leading farmers and planters can do no better work in their respective neighborhoods than to point out the short-sighted and foolhardy practice of allowing cattle to range at will, and to encourage in every way possible, the enactment and enforcement of fence laws* in their respective parishes.

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*By "fence law" we mean, not a law requiring a man to fence his farm and crops to keep other people's cattle *out*. but a law compelling every man to fence his own farm and keep *his own* cattle *in*.

LIFE HISTORY STUDIES OF THE CATTLE TICK AT BATON ROUGE.

In order to verify, and to secure an amplification of the data already obtained regarding the time required for hatching of tick eggs, and the length of time during which seed ticks can live without attaching themselves to cattle, at all seasons of the year, a critical study of the incubation periods of the eggs and survival periods of the seed ticks was commenced in August, 1905, and has been continued to the present time. It will readily be seen that positive knowledge regarding the time required to "starve out" the ticks in pastures, before non-infested cattle can be safely admitted to them, is absolutely essential to a successful application of the methods to be used in tick-eradication.

These studies were made in the following manner: On the 15th of each month five fully-engorged female ticks were taken from a cow and placed in the laboratory. Note was made of the date upon which they began depositing eggs, the number of eggs deposited each day and the period during which egg deposition was continued by each tick. The eggs laid by each tick, each day, after being counted, were transferred to a large test tube, and placed on moist white sand in its bottom, the tube being labeled with the number of the mother tick, and the date upon which the eggs in it were deposited.

The sand was kept constantly moist, and the laboratory room in which the tubes were kept had the windows open the year round, the air and humidity being practically identical with that of the atmosphere outside. Record was made of the date upon which each lot of eggs began hatching and of the date upon which the resulting seed ticks died. The records kept concerning the egg deposition by *one* of these females and the survival periods of the seed-ticks hatching therefrom, is shown in Figure 7, which is a reproduction of one of the record sheets as it was filled out from day to day. Many details regarding the peculiarities of the ticks were brought out by these studies, most of which will be of the utmost value in devising working plans for eradicating the tick under varying conditions and on farms having diverse arrangements of fields and pastures. As a recital of these various points in detail would be burdensome to the reader, the more essential features are given in Table I.

TABLE I.

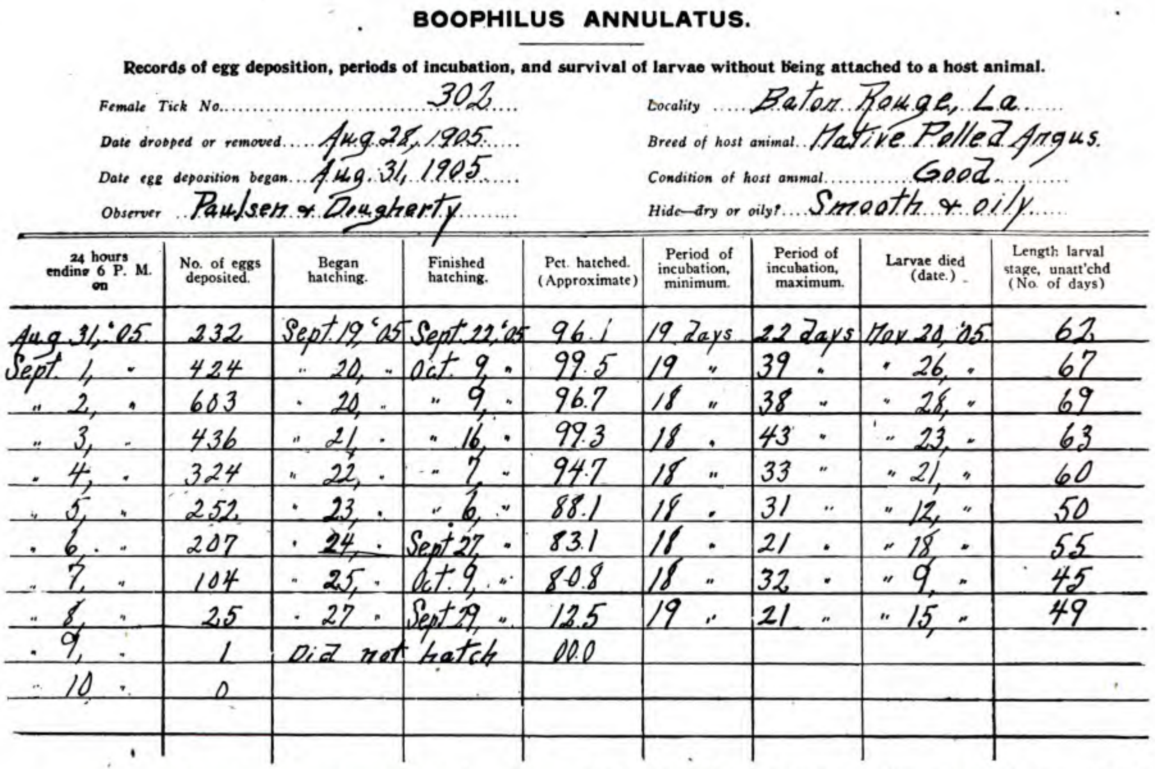
Periods of Incubation and Survival of Seed Ticks (unattached) for Year Ending August 1, 1906, at Baton Rouge, La.

Female tick No.	Date tick dropped from cow	Date first eggs hatched.	Maximum period of incubation, days.*	Date last resulting seed tick died.	Maximum survival of seed ticks, days.	Average daily mean temperature during incubation.†	Average daily mean temperature during seed tick stage.‡
301	Aug. 22, '05	Sept. 14, '05	39	Nov. 19, '05	66	80.1	71
302	Aug. 28, '05	Sept. 19, '05	39	Nov. 28, '05	69	89	69
303	Aug. 22, '05	Sept. 14, '05	41	Nov. 23, '05	71	82	69
304	Aug. 22, '05	Sept. 14, '05	49	Nov. 14, '05	61	81	71
305	Aug. 29, '05	Sept. 20, '05	34	Feb. 8, '06	139	85	60
306	Aug. 25, '05	Sept. 16, '05	47	Nov. 23, '05	67	80	69
307	Aug. 25, '05	Sept. 16, '05	58	Jan. 24, '00	130	89	63
308	Sept. 14, '05	Oct. 11, '05	61	Apr. 30, '06	190	69	61
309	Sept. 14, '05	Oct. 10, '05	39	Apr. 15, '06	178	72	59
310	Sept. 14, '05	Oct. 11, '05	56	May 6, '06	207	69	61
311	Sept. 14, '05	Oct. 10, '05	48	May 10, '06	212	69	59
312	Sept. 15, '05	Oct. 10, '05	40	May 3, '06	201	72	61
313	Sept. 15, '05	(Eggs did not hatch)		......	......	......	......
314	Sept. 14, '05	Oct. 10, '05	49	May 14, '06	210	72	61
315	Oct. 15, '05	Apr. 2, '06	178	June 5, '06	76	61	73
316	Oct. 15, '05	Mar. 15, '06	167	May 26, '06	45	59	87
317	Oct. 15, '05	Mar. 2, '06	153	May 27, '06	76	60	71
318	Oct. 15, '05	Mar. 1, '06	172	June 2, '06	79	60	72
319	Oct. 15, '05	Mar. 8, '06	169	June 7, '06	77	60	72
320	Oct. 15, '05	Mar. 1, '06	171	June 9, '06	82	64	73
321	Nov. 16, '05	Apr. 14, '06	146	June 8, '06	44	61	77
322	Nov. 16, '05	Did not deposit eggs		......	......	......	......
323	Nov. 16, '05	Apr. 14, '06	143	June 11, '06	38	61	79
324	Nov. 16, '05	Did not deposit eggs		......	......	......	......
325	Nov. 16, '05	Apr. 17, '06	129	June 17, '06	61	61	81
326	Dec. 15, '05	(Eggs did not hatch)		......	......	......	......
327	Dec. 15, '05	Apr. 23, '06	105	June 30, '06	65	64	81
328	Dec. 15, '05	Apr. 28, '06	96	May 22, '06	24	63	85
329	Dec. 15, '05	Did not deposit eggs		......	......	......	......
330	Dec. 15, '05	Did not deposit eggs		......	......	......	......
331	Dec. 15, '05	Did not deposit eggs		......	......	......	......
332	Jan. 15, '06	Eggs failed to hatch		......	......	......	......
333	Jan. 15, '06	Eggs failed to hatch		......	......	......	......
334	Jan. 15 '06	Eggs failed to hatch		......	......	......	......
335	Jan. 15, '06	Eggs failed to hatch		......	......	......	......
336	Jan. 16, '06	Eggs failed to hatch		......	......	......	......
337	Mar. 3, '06	May 3, '06	62	July 21, '06	68	68	82
338	Mar. 3, '06	May 6, '06	51	July 5, '06	77	65	79
339	Mar. 3, '06	May 5, '06	53	July 5, '06	61	66	82
340	Mar. 3, '06	Did not deposit eggs		......	......	......	......
341	Apr. 15, '06	May 20, '06	35	Aug. 2, '06	73	60	83
342	Apr. 15, '06	May 26, '06	36	Aug. 7, '06	72	70	82
343	Apr. 15, '06	May 20, '06	42	Aug. 8, '06	74	75	82
344	Apr. 15, '06	May 20, '06	37	Aug. 1, '06	69	78	82
345	May 15, '06	Did not deposit eggs		......	......	......	......
346	May 15, '06	June 8, '06	26	Aug. 12, '06	63	86	83
347	May 15, '06	June 10, '06	30	Aug. 25, '06	41	86	82
348	June 15, '06	July 14, '06	30	Sept. 14, '06	62	83	85
349	June 15, '06	July 10, '06	27	Sept. 8, '06	61	88	87
350	June 15, '06	July 10, '06	30	Sept. 11, '06	60	89	82
351	June 15, '06	July 10, '06	29	Sept. 10, '06	68	87	83
352	June 15, '06	July 14, '06	34	Sept. 8, '06	55	83	83
353	July 15, '06	Aug. 13, '06	31	Sept. 13, '06	59	86	81
354	July 15, '06	Aug. 13, '06	39	Oct. 13, '06	59	86	81
355	July 15, '06	Aug. 13, '06	44	Oct. 15, '06	58	86	80
356	July 15, '06	Aug. 13, '06	27	Oct. 8, '06	58	81	81

*Namely, greatest length of time required for incubation of any one egg in lot deposited by the one female.

†Average daily mean from deposition of first egg by the individual female until hatching of last one.

‡Average daily mean for period from hatching of first egg until the death of last seed tick hatching from that lot.



BOOPHILUS ANNULATUS.

Records of egg deposition, periods of incubation, and survival of larvae without being attached to a host animal.

Female Tick No. 302

Date dropped or removed Aug. 28, 1905

Date egg deposition began Aug. 31, 1905

Observer Paulsen & Dougherty

Locality Baton Rouge, La.

Breed of host animal Native Polled Angus.

Condition of host animal Good

Hide—dry or oily? Smooth & oily

24 hours ending 6 P. M. on	No. of eggs deposited.	Began hatching.	Finished hatching.	Pct. hatched. (Approximate)	Period of incubation, minimum.	Period of incubation, maximum.	Larvae died (date.)	Length larval stage, unatt'chd (No. of days)
Aug. 31, '05	232	Sept. 19 '05	Sept. 22, '05	96.1	19 days	22 days	Nov. 20, '05	62
Sept. 1, "	424	" 20, "	Oct. 9, "	99.5	19 "	39 "	" 26, "	67
" 2, "	603	" 20, "	" 9, "	96.7	18 "	38 "	" 28, "	69
" 3, "	436	" 21, "	" 16, "	99.3	18 "	43 "	" 23, "	63
" 4, "	324	" 22, "	" 7, "	94.7	18 "	33 "	" 21, "	60
" 5, "	252	" 23, "	" 6, "	88.1	18 "	31 "	" 12, "	50
" 6, "	207	" 24, "	Sept 27, "	83.1	18 "	21 "	" 18, "	55
" 7, "	104	" 25, "	Oct. 9, "	80.8	18 "	32 "	" 9, "	45
" 8, "	25	" 27, "	Sept 29, "	12.5	19 "	21 "	" 15, "	49
" 9, "	1	Did not hatch		00.0				
" 10, "	0							

FIG. 7. Record sheet, showing egg deposition, time required for hatching of the eggs deposited each day and survival of the resulting seed ticks (unattached), as filled out in the laboratory from day to day. (Original.)

Aside from the many details given in Table I, these studies brought out a number of points of general interest, among them the following:

The greatest number of eggs deposited by any one female, during these observations, was 4,124,* this number having been deposited by a female which dropped from the cow on July 15, 1906. The average daily mean temperature while this tick was laying was 82 degrees F.

The largest number of eggs deposited by one female in 24 hours was 993 (or an average of one egg every minute and a half). This record was made upon July 23, 1906, the maximum temperature on that day being 91 degrees and the minimum 84 degrees.

The shortest length of time in which any single egg hatched was 16 days (deposited, with others, on July 2 and hatching on July 18, 1906), the average daily mean temperature during this period being 82.8 degrees.

The longest time required for the hatching of any one egg was 178 days (deposited with others, on October 25, 1905, and hatching on April 21, 1906), the average daily mean temperature during this time being 60.2 degrees.

During the year in which these observations were made, the lowest temperature reached was 32 degrees† (on February 7, 1906), and the highest was 97 degrees (on August 25, 1906).

The shortest time in which all the seed ticks of any one lot (those hatching from eggs deposited during one day, by a single female) perished was 11 days. These particular seed ticks hatched on April 20, 1906, and were all dead by May 1, 1906,‡ the average daily mean temperature during that period being 75.9 degrees.

The greatest length of time required for the death, by starvation, of any one lot of seed ticks was 212 days, from October

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*A female tick which was taken from a cow at Keatchie, La., on May 16, 1905, and kept in our former laboratory at Shreveport, La., deposited a total of 4,244 eggs.

†As stated on a previous page, the temperatures recorded are those which prevailed in the laboratory, which was so arranged that the temperature and humidity were practically the same as that out-of-doors during the same time. Instruments kept out-of-doors for check purposes constantly recorded a temperature from 1 to 2 degrees higher or lower than that in the tick laboratory.

‡These were eggs which had been deposited the previous October. These observations brought out in a most striking manner the fact that seed ticks hatching from the over-wintering eggs are very deficient in vitality as compared with those which hatch in shorter periods during the warmer portions of the year.

10, 1905, to May 10, 1906, the average daily mean temperature during that period being 62 degrees.

Eggs submerged under water during the entire period of incubation did not require an appreciably longer time for hatching, during warm weather, than did eggs not submerged. In the case of similar experiments made in submerging eggs during cold weather, all the eggs failed to hatch.

The percentage of eggs hatching, when deposited at different seasons of the year, varies greatly. Table II gives the per cent which hatched from eggs deposited during the different months.

TABLE II.

Per Cent of Tick Eggs Hatching, When Deposited During Different Months.

Month Deposited.	Per Cent hatching.
January, 1906	00.0
February, 1906	No eggs deposited.
March, 1906	22.7
April, 1906	78.6
May, 1906	82.2
June, 1906	61.6
July, 1906	92
August, 1905	85.6
September, 1905	69.3
October, 1905	50.3
November, 1905	4.7
December, 1905	18.5

The data in Table I makes it possible for us to tell the length of time required to starve out all seed ticks in fields and pastures at any and all seasons of the year. For example, if all cattle are taken from a pasture on August 15, and all cattle are kept out of that pasture until the 30th of the following May, all eggs in the field will have hatched and the resulting seed ticks died of starvation, so that after the latter date tick-free cattle can be placed on the pasture in question without any danger of their becoming re-infested with the ticks. In ridding a pasture or field of the ticks in this manner, namely, starving them out, it is absolutely necessary that *all* cattle (both tick-infested and tick-free) be kept out of it during the "starvation period." If tick-free cattle were admitted to it during this period they would become infested, and if ticky cattle were admitted they would drop egg-laying ticks which would result in added infestation of the pasture and a consequent postponement of the date when it would become tick-free.

The work of starving out the seed ticks in a pasture may be begun at any season of the year, and the dates between which all cattle must be kept out of the pasture to thoroughly rid it of all the ticks, are given in Table III.

TABLE III.

Time Required to Rid a Pasture of Ticks When All Cattle Are Kept Out of It.

If All Cattle Are Removed from the Pasture on .	The Pasture Will Be Tick-Free by the Following
August 15	May 30
September 15	May 30
October 15	June 20
November 15	June 30
December 15	July 15
January 15	July 30*
February 15	July 30*
March 15	July 30
April 15	August 15
May 15	August 15
June 15	September 15
July 15	October 15

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*Eggs deposited by the few adult female ticks which we were able to find during January did not hatch, and during February no ticks at all could be found on the cattle, but it must be self-evident that even were an occasional tick to mature on the cattle during January or February, her progeny would die a least as soon as the progeny of female ticks dropped during March.

A SIMPLE PLAN FOR ERADICATING THE TICK ON FARMS AND PLANTATIONS.

Although the preceding notes and tables furnish the data from which plans may be devised for eradicating the tick, commencing at any season of the year, we have thought best to outline what appears to be the most simple method and one which, furthermore, involves least expense, and can be commenced the coming month (December). The plan outlined below is applicable to the majority of farms in Louisiana, without the necessity of any material changes being made in the arrangement of fields and pastures. Of course a vast number of modifications of this plan may be made, suited to the conditions prevailing upon the particular farm where tick-eradication is undertaken. When one understands thoroughly the life history of the cattle tick, knows the length of time required for the hatching of the eggs at different seasons of the year, and the time required for the seed ticks to die out in pastures when all cattle are kept out of them (all of which is given on the preceding pages) he can devise a plan of tick-eradication which will be successful anywhere in Louisiana.

The plan here outlined is based upon two essential facts, first, that eggs deposited by the female ticks after the arrival of cool weather do not hatch until the following spring, and, secondly, that all fields which have been in cultivation (as in corn, cotton, rice or cane) during the summer are tick-free on December 1 (unless cattle have been admitted to them during the summer or autumn, which is not usually the case).

If the cattle, infested with ticks, be taken from their pasture (likewise infested with ticks) and placed in a corn or cotton field at any time between December 1 and 25, they will immediately escape from the re-infestation by seed-ticks to which they are exposed in the ticky pasture.

Ticks which are upon the cattle when they are placed in the corn or cotton field continue to grow, and when full-grown drop to the ground. By the 15th of February all the ticks will have dropped off, leaving the cattle tick-free. Up to this time the cattle will have picked up no seed ticks, for the eggs deposited by the females dropping from them will not have hatched on account of the cool weather.

72-4

Between February 15th and 20th the cattle should be removed from the corn or cotton field and placed in a *tick-free* field. We will then have our tick-free cattle upon a tick-free field, and so long as they are kept on tick-free areas, and no ticky animals permitted to enter the fields or pastures where they are, they *will remain tick-free.*[*]

The tick-free area to which the cattle are transferred in February may be a field that has been in cultivation the previous year and in which no cattle have been permitted since the previous summer (June 30th), it may be a hay or alfalfa field from which all cattle have been excluded for a similar length of time, or it may be a regular pasture field *out of which all cattle have been kept since the* 30th *of the previous June.* After being taken out of the corn or cotton field, tick-free, on February 15th, the cattle must thenceforth be kept out of all tick-infested pastures or yards. The original pasture (vacated by the cattle in December) will, if all cattle are kept out of it, be free of ticks by July 15th, and the tick-free cattle can then be returned to it, there to remain permanently.

A tick-free area, upon which to keep the cattle from February 15th to July 15th, can be found or arranged for upon almost any farm.[†] If no tick-free pasture is available at the present time, a part of any corn or cotton field can be fenced off and winter oats or alfalfa planted to furnish pasturage for the cattle in the spring, or until they can be safely returned to their original pasture on July 15th.

If it is impossible to find or arrange for a tick-free area upon the farm, ready to receive the tick-free cattle in February, the next best thing for the farmer to do is to plan the coming year's operation of his farm so that he can remove all cattle from some one pasture field on June 30, 1907, and keep them out of it after that date so that this pasture will be tick-free a year from this winter, when the plan of freeing the cattle by placing them in a corn or cotton field, as outlined above, can be carried out and the cattle then placed in this tick-free pasture in February, 1908.

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[*] Horses, mules and colts, before being admitted to a tick-free pasture, should be critically examined, *all over*, to see that no ticks are on them. Horses and mules which have access to tick-infested areas should not be allowed to mingle with tick-free cattle, nor should they be permitted to enter tick-free pastures which are *being* freed of the ticks.

[†] It has been found that eggs and seed ticks are sometimes transported by water in running streams or during floods and are in this way carried from heavily infested pastures into tick-free pastures further down stream, thus resulting in infestation of the latter. In making any particular field or pasture tick-free, the source of water supply and the nature of the pasture and fields "up stream" from it must be taken into consideration.

A creek or small bayou running through a tick-free pasture is not likely to result in tick-infestation of the latter if all the fields along its banks above are in cultivated crops. If, on the other hand, cattle are pastured along the stream and are heavily infested with ticks, infestation of the pasture is almost sure to result. In cases like the latter, either the up-stream neighbor should be induced to free his cattle from ticks also, both for his own benefit and for that of the community, or the cattle in the tick-free pasture must be kept from the stream by a cross-fence and water supplied them from a well, spring or stock pond, the latter made by throwing a dam across some small valley, forming a reservoir to catch and hold rain water.

Figure 8 is a diagram of a small farm as it is at the present date (November, 1906), the movement of the cattle from field to field in freeing both them and the fields of ticks, being indicated by the arrows and the dates alongside of them.

Some few farmers have objected to total extermination of the tick upon their farms upon the ground that calves born *after* the ticks are all exterminated will be non-immune and hence liable to attacks of Texas fever in future years if ticky animals should by accident get on to the farm from neighboring or distant infested farms, or if such non-immunes were taken to ticky farms. To this it may be answered that even were occasional deaths, by fever, to occur as the result of a ticky animal "breaking into" the tick-free farm, these losses would be but small compared with the aggregate losses due to the loss of flesh by every animal, every year, on the tick-infested farm.

In the second place, non-immune cattle, before being taken to other farms which may be tick-infested, can be rendered "immune" by inoculation with blood from the "native" or "immune" animals (for details of which see Bulletin 84 of the State Experiment Station, referred to on page 31). Calves can also be cheaply and easily immunized by the blood-inoculation method and thus be protected against the fever which would follow their accidental infestation by the ticks in after years.

The writers will take pleasure in corresponding with any farmer who wishes to rid his farm and cattle of this costly pest and who finds difficulty in arranging the necessary rotation plan by which to exterminate the tick under the particular conditions prevailing on his farm.

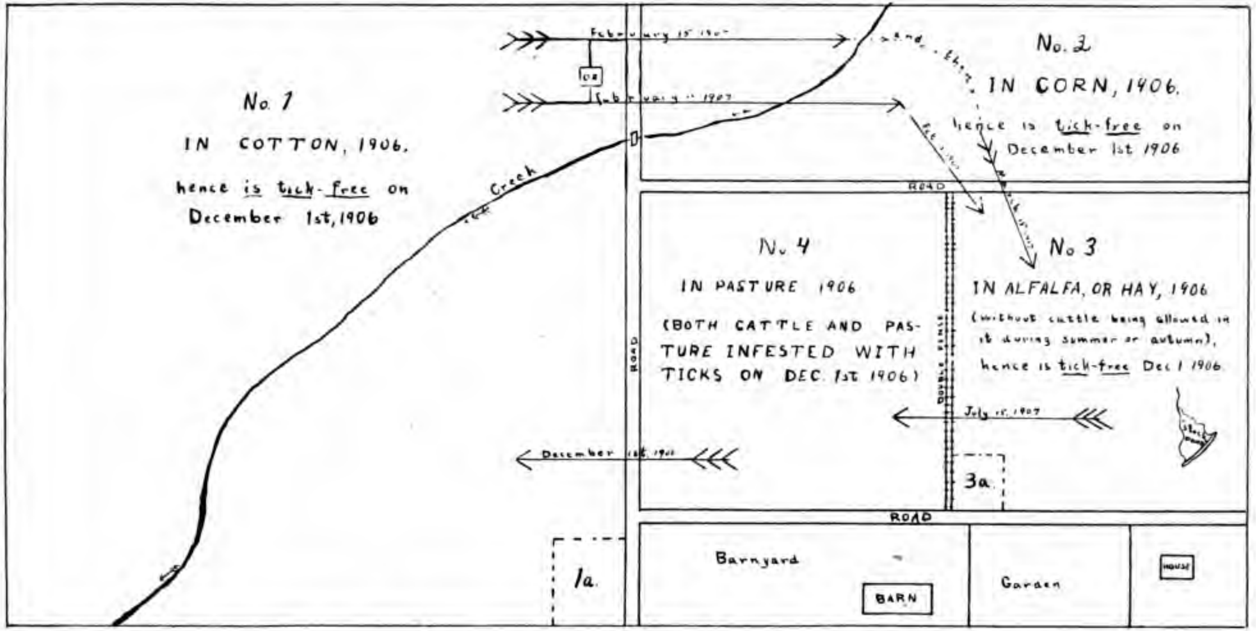

FIG. 8. Map of farm illustrating winter rotation plan of eradicating the tick. Large arrows indicate dates and manner of moving cattle. Eradication is begun by taking all the cattle out of pasture (No. 4) between Dec. 1 and 25 and placing them in cotton field (No. 1), in the corner of which a milking lot (1a) can be fenced off if needed (none of the cattle must be permitted to re-enter the pasture or barnyard before July 15, 1907). On Feb. 15 the cattle (now tick-free) are taken from the cotton field and placed in former corn field (No. 2) until March 15, when they are placed in the hay field (No. 3); or, on Feb. 15 they can be taken direct from No. 1 to No. 3. (No. 4 should be separated from No. 3 by a double fence to prevent ticks in No. 4 getting on the cattle in No. 3 during the spring and early summer.) While they are in No. 3 a milking lot, or calf lot, can be fenced off at 3a if desired. On July 15 the cattle are returned to the original pasture (now tick-free) and can be allowed access to the barnyard (also tick-free by July 15). If no ticky animals are allowed to come on the farm, cattle and farm will thenceforth remain free of cattle ticks. (Original.)

PUBLICATIONS CONCERNING TICKS AND TEXAS FEVER, WHICH SHOULD BE IN THE HANDS OF EVERY LOUISIANA FARMER.

"TEXAS FEVER."

By DR. JOHN R. MOHLER.

(Bulletin 78, Bureau of Animal Industry, United States Department of Agriculture, 1905.)

A discussion of Texas fever, its cause, symptoms, diagnosis, the relation of the cattle tick thereto, the importance of tick-eradication and the methods of eradication. Also contains colored plates showing life history of the tick and the difference between this and other species of ticks. Can be secured from the Hon. Secretary of Agriculture, Washington, D. C.

"TEXAS FEVER."

By DR. W. H. DALRYMPLE.

(Bulletin No. 84 of the Louisiana State University Experiment Stations, 1905.)

A general summary of our knowledge of the subject to date. Deals particularly with immunity by blood-inoculation and with the rotation and feed-lot systems of exterminating the tick. Can be secured free, upon application to Prof. W. R. Dodson, Director, Baton Rouge, La.

"TEXAS OR TICK FEVER AND ITS PREVENTION."

By DR. JOHN R. MOHLER.

(Farmers' Bulletin No. 258 of the United States Department of Agriculture.)

Covers practically the same ground as Bulletin 78 of the Bureau of Animal Industry, referred to above, but is less technical. Discusses tick fever, methods of tick-eradication, and explains the operation of the Federal live-stock sanitary regulations, under which the Federal quarantine protecting the Northern States from tick invasion is enforced. Can be secured free from the Hon. Secretary of Agriculture, Washington, D. C.

"THE CATTLE TICK IN ITS RELATION TO SOUTHERN AGRICULTURE."

By MR. AUGUST MAYER, OF SHREVEPORT, LA.

(Farmers' Bulletin No. 261 of the United States Department of Agriculture, 1906.)

Explains the enormous drain upon Southern agriculture, occasioned by the tick, and points out the enormous benefits that would follow if the tick were eradicated from the South. Written by a practical farmer and cattleman, it graphically portrays the tick situation as viewed from the standpoint of the Southern farmer. This publication may be secured by addressing the Secretary of Agriculture, Washington, D. C., or upon application to the State Crop Pest Commission, Baton Rouge, La.

"HOW TO GET RID OF CATTLE TICKS."

By DR. A. D. MELVIN.

(Circular No. 97 of the Bureau of Animal Industry, Washington, D. C., 1906.)

This circular tells how to free small numbers of cattle from ticks by hand-picking and greasing. While involving too much labor and expense for adoption in the case of large herds or upon plantations, the method advocated is well adapted to use where only a few cattle or milch-cows are kept, as on town or city premises where a change or rotation of lots or pasturage is impossible. Can be secured by addressing the Secretary of Agriculture, Washington, D. C.

"THE CATTLE TICK—Studies of the Egg and Seed Tick Stages—A Simple Method of Eradicating the Tick."

By WILMON NEWELL and M. S. DOUGHERTY.

(Circular No. 10 of the State Crop Pest Commission of Louisiana. November, 1906.)

The State Crop Pest Commission not only takes pleasure in sending this publication to the farmers on its mailing list, but the Commission will also be pleased to mail copies of this circular to *your* neighbors who own cattle, if you will kindly send their names and addresses to Wilmon Newell, Secretary, Baton Rouge, La.

INQUIRIES ABOUT INSECTS

Are cheerfully answered (always free of charge) by the Entomologist of the State Crop Pest Commission and his assistants. When writing for information concerning some insect which is injurious to your fruits or crops, give as full an account of its habits and work as possible. If it is possible to do so, send also specimens of the insect, together with leaves or parts of the plant it is feeding on, to serve it as food while en route.

Insects sent by mail MUST be put up in tight TIN or WOODEN boxes, SEALED (postage 2 cents per ounce), and WITHOUT ANY OPENINGS IN THE PACKAGE. (The admission of air to the insects is not necessary—they will live just as well without it.) The name and address of the sender should be plainly written on the wrapper of the package, as the Commission receives many packages of this kind and *your* package may be mistaken for some one else's if it is not plainly labeled with your name.

Remember that it is AGAINST THE LAW to send insects through the mail inclosed only in glass bottles or vials, and that sending BOLL WEEVILS through the mails is PUNISHABLE BY IMPRISONMENT. Insects sent loose in letters or in pasteboard boxes are invariably broken up in the mails, so that they cannot be recognized on their arrival at Baton Rouge.

The Circulars of the Commission upon various injurious insects and how to combat them, are sent free of charge to all farmers of the State who desire them.

Send us the names and addresses of the progressive farmers and fruit growers in your neighborhood, and we will advise them promptly what Circulars are still available for distribution. BY SO DOING YOU WILL HELP US PLACE VALUABLE INFORMATION IN THE HANDS OF THE MEN WHO NEED IT. Address all communications to

STATE CROP PEST COMMISSION OF LOUISIANA,

Baton Rouge, La.

724

CIRCULAR NO 11

OF THE

State Crop Pest Commission

OF

LOUISIANA.

THE BOLL WEEVIL.

Report on the Cultural Experiments in Co-operation with the Bureau of Entomology during 1906.

BY

C. W. FLYNN, Jr.

Issued Under the Direction of the State Board of Agriculture and Immigration.

CHAS. SCHULER, Commissioner.

Baton Rouge, La.
The Times Publishing Company.
1907

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STATE CROP PEST COMMISSION OF LOUISIANA.

ORGANIZATION.

HON. NEWTON C. BLANCHARD, Governor of Louisiana.

HON. CHAS. SCHULER, Commissioner of Agriculture.

PROF. W. R. DODSON, Director, State Experiment Stations.

WILMON NEWELL, Entomologist, State Experiment Stations.

HON. L. S. FRIERSON.

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STAFF.

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MISS L. E. RENNEKER, Clerk and Accountant.

J. B. GARRETT, Assistant Entomologist, Boll Weevil Investigations.

C. W. FLYNN, Assistant Entomologist, Boll Weevil Investigations.

HARPER DEAN, JR., Assistant Entomologist, Miscellaneous Investigations.

MALCOLM S. DOUGHERTY, Assistant Entomologist, Cattle Tick Investigations.

ARTHUR H. ROSENFELD, Assistant Entomologist, Nursery and Orchard Inspection.

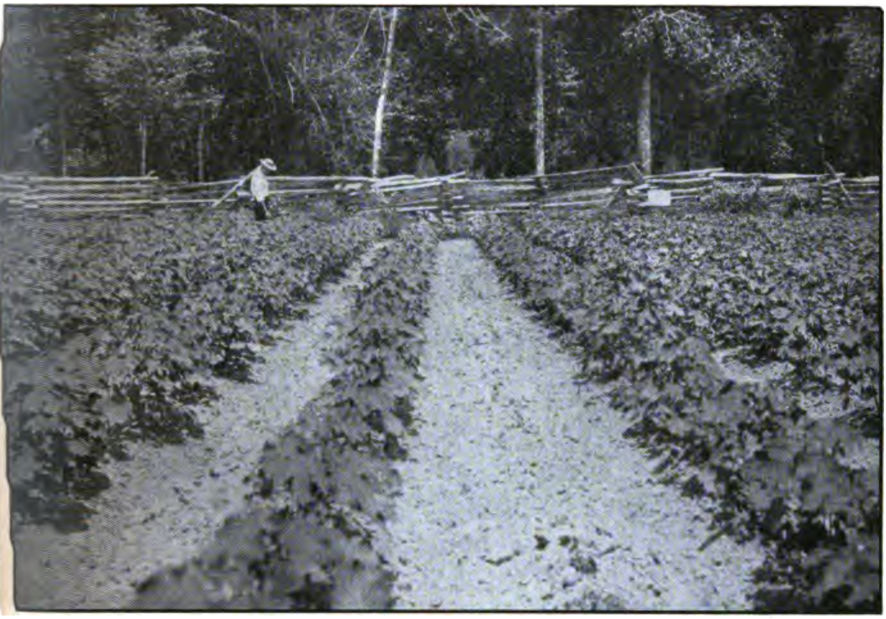

Fig. 1.—Plat of Triumph cotton in Logansport experiment. (Note the finely pulverized soil between the rows). Photographed June 11, 1906.

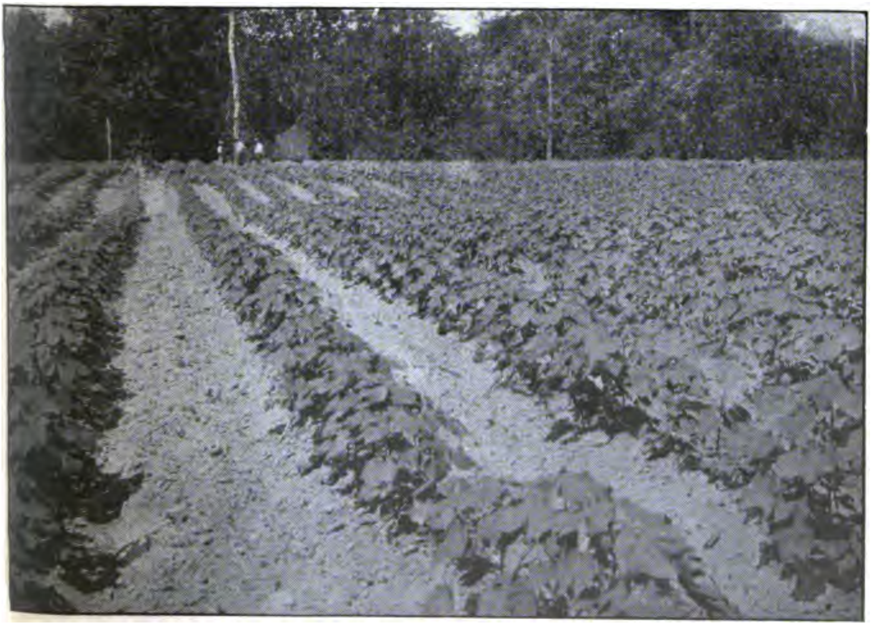

Fig. 2.—Cotton field of Mr. D. J. Bland at Logansport, La. Photographed June 11, 1906. (See page 8).

State Crop Pest Commission
OF LOUISIANA.

CIRCULAR No. 11. January, 1907.

The Circulars of the State Crop Pest Commission are sent free of charge to all farmers and fruit growers of Louisiana who make application therefor.

The Boll Weevil.

REPORT ON THE CULTURAL EXPERIMENTS IN CO-OPERATION WITH THE BUREAU OF ENTOMOLOGY DURING 1906.

By C. W. FLYNN, JR.

INTRODUCTION.

It is with considerable satisfaction that the State Crop Pest Commission is enabled to report the excellent results, given herein, which have been obtained in the cultural experiments conducted during the past year in co-operation with the Bureau of Entomology of the United States Department of Agriculture.

In view of the fact that the effectiveness of the cultural methods of combating the boll weevil has been so thoroughly demonstrated by the experimental work of both the Department of Agriculture and of the State Crop Pest Commission, further experimental work along this line would almost appear to be unnecessary, as the cultural system of raising cotton in defiance of the boll weevil is no longer a theoretical project, but a thoroughly established and successful method, now being practiced by thousands of farmers in Texas and Louisiana.

The experiments of 1906 were undertaken primarily for ascertaining just how much cotton could be produced by the cultural methods in the face of the heaviest possible infestation by the weevil, and for testing the adaptability of several early-maturing varieties of cotton upon different soils and in different localities.

Definite figures on the exact increase in production due to the judicious use of fertilizers was also desired and, secondarily, it was expected that the experimental work, in the heavily infested sections at least, would not be without benefit in demonstrating to the resident farmers the practicability and success of the "cultural remedy."

Only those varieties were used which gave most promise, viz., "King," "Triumph," and seed from Southern Missouri (and referred to on subsequent pages as "South Missouri"[*]).

These were so tested as to permit a ready comparison of them one with another, and with the "native" cotton. In most cases both fertilized and unfertilized fields of each variety were planted in the experiments. Cultivation was thorough in all cases and the same cultivation was given all the plats in each experiment.

The experiments were conducted at three points, Logansport, Alexandria and Batchelor; these three localities presenting a range in varied conditions sufficiently great to render the conclusions safely applicable to all localities in the State. The experiment at Logansport was located upon good upland or "hill" soil, on land that had been in cultivation for several years. Perhaps no point in all of the weevil-infested regions of Texas and Louisiana has ever experienced such an abundance of boll weevils as has the neighborhood of Logansport the past year, and it is safe to predict that no portion of Louisiana will ever be more thoroughly infested. Continuous infestation by the pest for three years and the mild winter of 1905-06, followed by a favorable spring and summer, resulted in a state of affairs calculated to be well-nigh discouraging to the cotton planter in that portion of Louisiana. The making of nearly one bale of cotton per acre under such conditions, as was done in the Logansport experiment, should convince even the most skeptical as to the efficiency of "early varieties, early planting, judicious fertilizing and thorough cultivation."

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[*] It should be made clear at the outset that "South Missouri" is *not a variety* of cotton. When seed from the northern portion of the cotton belt is brought to the southern portion and there planted, the resulting crop matures much earlier than the average native cotton. If seed from this first crop be again planted, the resulting crop, viz., second crop, will be later than the first, In the case of "northern grown" seed therefore, new seed must be obtained from the northern part of the cotton belt at least every two years, as such cotton does not *retain* indefinitely its character of earliness like *true* varieties such as King or Triumph.

The experimental plats at Alexandria were located upon typical Red River Valley land. Although reached by the advance guard of the boll weevil migration in 1905, no weevils appeared in the experimental fields here early in the spring. However, the August migration of 1906 reached these fields and this resulted in heavy infestation of the cotton after the middle of August.

At Batchelor, the experiments were upon a typical Mississippi Valley plantation. Batchelor has not yet been reached by the boll weevil, but the experiment here was undertaken that we might know the behavior of the earlier cottons on this soil and under the conditions here prevailing, in order that the Commission will be prepared to recommend the proper varieties when this area becomes infested, which will doubtless be within one or two years.

Three different fertilizers were tested, the applications in all cases being at the rate of three hundred pounds per acre. Acid phosphate containing 15 per cent of available phosphoric acid was used as the source of phosphoric acid and cotton seed meal furnished the nitrogen, while the potash utilized was in the form of kainit.

The "11-2-0" fertilizer was made in the proportion of 200 pounds (15 per cent available) acid phosphate to 100 pounds of cotton seed meal; this mixture containing 11 per cent of available phosphoric acid, 2 per cent of nitrogen and practically no potash (.29 per cent). The "10-0-4" fertilizer was made of the same phosphate, with kainit, 200 pounds of the former to 100 pounds of the latter. This mixture contained 10 per cent of phosphoric acid, no nitrogen and 4 per cent of potash.

The acid phosphate, containing 15 per cent available acid, was also used as a fertilizer by itself, without being mixed with other materials.

THE EXPERIMENT AT LOGANSPORT.

The experiment here was carried out by Mr. D. J. Bland, a practical farmer, under direction of the writer. The land, as previously mentioned, was good upland soil, in a good state of cultivation. This experiment was undertaken under conditions most unfavorable to a good yield. Not only were the weevils exceedingly abundant, but the cotton plants on these fields had not been destroyed the previous autumn—one of the most essential steps in the successful application of the cultural methods. Had the cotton plants been destroyed the previous fall doubtless we would be able to report far larger yields on these plats for 1906. As it is, the results indicate what can be done by the use of early-maturing varieties, properly cared for, when the fall destruction of the plants is omitted.

The experimental field was divided into five plats of approximately two acres each, planted to King, Triumph, South Missouri and native cotton unfertilized. The remaining plat was planted in native cotton and was fertilized with 300 pounds of "11-2-0" fertilizer per acre.

The land was given thorough preparation and all plats planted April 4th and 5th. Frosts on April 14th and 15th injured the stand, but replants were not made. Three choppings, or hoeings, were given, about April 30, May 22 and June 13. The cultivation was shallow, the top soil being kept thoroughly pulverized and almost in the form of a dust mulch (See Figures 1 and 2). Nine cultivations were given the crop by Mr. Bland, timed approximately as follows: May 6, May 10, May 18, May 25, June 14, June 20, June 30 and July 5.

Boll weevils were present in the fields from the beginning and by the latter part of May were abundant. A count of squares on June 5th showed 2.7 per cent of them infested, the infestation being practically uniform over the fields. On July 13 the percentage of squares infested was 24.3 and maximum infestation (100 per cent of squares infested) was reached about August 1.

The experiment attracted considerable attention throughout the season, many planters from a distance going to Mr. Bland's place for the purpose of seeing the excellent care given the crop by Mr. Bland. The latter gentleman was also in receipt of a number of letters concerning the experiment and its results. We quote the following from an interesting letter written by Mr. Bland to Mr. W. E. Glassell of Shreveport, under date of September 14, 1906:

> "I received a letter a few days ago asking me to write you something regarding the cultural experiment which I am conducting for the Crop Pest Commission. The crop was 'laid by' in July and the cotton is now all open. From the two-acre plat planted in South Missouri seed, I have picked 1,540 pounds[*] seed cotton and have about 300 pounds more to pick. I will pick about 2,100 pounds from the plat planted in native seed and fertilized with 11-2-0 fertilizer.[†] I think the Triumph and King cotton will produce about 900 pounds[‡] seed cotton per acre, and the native seed (unfertilized) about 700 pounds[§] seed cotton per acre.
>
> "I do not think I have overestimated any of the yields, but, of course, cannot tell until all of it is weighed in.
>
> "Now, as to whether the test was satisfactory or not, I can best answer by giving a comparison of my crop, raised by the cultural methods, with that of my neighbors, raised by the old method. My land, prior to the advent of the weevil, produced from 1,000 to 1,500 pounds seed cotton per acre. My neighbor, just one-half mile away, told me a few days ago that he would get about 400 pounds seed cotton per acre on land equally as productive as mine. Another neighbor, three-fourths of a mile away, tells me that he will get about three bales to twenty acres. Another neighbor, two miles away, claims that he will get about 300 pounds seed cotton per acre. The weevils were very abundant in all of these fields and appeared in my field about the same time and were just as abundant as in any of the other fields."

Mr. Bland kept notes on the dates of appearance of the first squares, blooms and open bolls, which are given below. While the number of days from planting to first open bolls is nearly the same for all varieties, the Triumph and South Missouri cottons matured their fruit as a whole much earlier than the others.

Variety	Date of planting.	Date of 1st squares.	Date of 1st blooms.	Date of 1st open bolls.	No. days from planting to 1st open bolls
Native unfertz.	April 5th	May 17th	June 13th	July 25th	111 days
Native fertz	" 4th	" 14th	" 11th	" 25th	112 "
Triumph.	" 4th	" 17th	" 11th	" 25th	112 "
King....	" 4th	" 17th	" 11th	" 22nd	109 "
South Missouri	" 4th	" 17th	" 12th	" 22nd	109 "

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[*] The total season's production on this plat was 1006 lbs. of seed cotton per acre.

[†] Total production was 1194 lbs. seed cotton per acre.

[‡] Total production of the Triumph was 1155 lbs., and of the King 1027 lbs. seed cotton per acre.

[§] Native, without fertilizer, produced 948 lbs. seed cotton per acre.

Table Showing Production of the Different Varieties in the Logansport Experiment.

Variety.	Fertilizer used.	Commenced picking.	Finished picking.	No. lbs. seed cotton produced per acre.
Native....	None	Sept. 28th	Oct. 10th	948 pounds
King.....	None	Sept. 18th	Sept. 28th	1027 "
*So. Mo..	None	Aug. 10th	Oct. 23rd	1006 "
Native....	11-2-0	Sept. 13th	Sept. 28th	1194 "
Triumph..	None	Oct. 10th	Oct. 23rd	1155 "

In fields of his own not in the experiment, Mr. Bland obtained results paralleling those in the experiment. Mr. Bland planted King, Triumph and South Missouri seed and fertilized with 200 pounds of 11-2-0 fertilizer per acre; 3,400 pounds of seed cotton were picked from three and one-third acres of King, 1,092 pounds from twenty-three-twenty-ninths of an acre of Triumph and 1,357 pounds from twenty-six-twenty-ninths of an acre of South Missouri. These fields, like the experimental plats, were heavily infested throughout the growing season.

By taking both Mr. Bland's fields and the experimental plats into consideration, an interesting comparison can be made between the production of the fertilized and the unfertilized cottons.

Table Showing Difference in Production Between Fertilized and Unfertilized Cotton.

Variety.	Unfertilized.	Fertilized with 200 lbs. 11-2-0 per Acre	Gain from use of fertilizer.
Triumph	1155 pounds	1382 pounds	227 pounds
South Missouri..	1006 "	1508 "	502 "
Native..........	948 "	1194 "	246 "

THE EXPERIMENT AT ALEXANDRIA.

The experiments at this point were carried on by Mr. W. C. Harris on Willow Glen plantation. The soil may be characterized as good Red River Valley soil and typical of the better soils of the Valley in that part of the State.

Three early-maturing varieties of cotton, King, Triumph and South Missouri, were planted in comparison with native

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*Mr. Bland notes that more than half of the South Missouri cotton was open by August 10th.

cotton, each plat containing approximately two and three-fourths acres.

The planting was done during the latter part of March, and a good stand secured, but frosts on April 14th and 15th materially damaged the stand, making replanting necessary.

Owing to a series of unavoidable misfortunes, records of the pickings were not obtained, except in the case of the Triumph variety. As stated on a previous page, the boll weevils did not appear on this plantation in the spring, but reached it in great numbers with the August migration, later destroying practically all top-crop.

The cotton was thoroughly cultivated, and Mr. Harris states that the average production for every variety was in excess of one bale per acre. The following table, compiled from notes kept by Mr. Harris, shows the time from planting to opening of first bolls. It will be noted that all the varieties required from twelve to eighteen days longer for reaching maturity on this soil than they did on the warmer upland soil at Logansport. (See p. 9.)

Variety.	Date of planting.	Date of 1st squares.	Date of 1st blooms.	Date of 1st open bolls.	No. days from planting to 1st open bolls.
Triumph	Mar. 31	June 2	June 10	July 31	122 days
So. Mo..	" 21	" 3	" 6	" 25	126 "
King....	" 22	" 2	" 9	" 24	124 "
Native unfertz.	" 23	" 2	No record	" 28	127 "

The following is an extract from a letter, dated December 8, 1906, written this Department by Mr. Harris:

> "I saw enough to satisfy me that the Triumph cotton is the cotton for us to plant here. I have secured four tons to plant next year. The plat the Triumph seed were planted on originally contained 2.75 acres. During the second week of September, after one picking had been made, about one-fourth of an acre was destroyed by the Rock Island Railroad going through the plat. That piece of cotton made four bales, weighing 480, 510, 540 and 515 pounds, respectively. Deducting 25 pounds for bagging and ties on each bale, it leaves 1,945 pounds lint cotton. The other plats made fine yields, as did the whole plantation. We had in all not over 1,200 acres in cotton that will produce 1,250 bales, averaging 585 pounds per bale."

THE EXPERIMENT AT BATCHELOR.

(Pointe Coupee Parish.)

The experiment at this point, which we deem of much importance on account of its having given us definite knowledge concerning the adaptability of the early varieties in the Mississippi Valley proper, was carried out by Mr. J. E. Byram.

The type of soil upon which the experiment was located is characteristic of the valley, and for many years was subjected to overflows prior to the perfection of the levee system which now protects it. Indications point to the weevil doing its maximum damage when it reaches these rich alluvial lands. For this reason a knowledge of the adaptability of the early varieties of cotton under these conditions should be very useful data to those who expect to continue raising cotton in this section after it becomes infested.

About eight acres of land were selected and divided into four two-acre plats. Upon each of the plats a different variety of cotton was planted. Each two-acre plat was then subdivided into four half-acre plats. One of the half-acre plats of each variety was left unfertilized and to each of the other plats fertilizer was applied; 11-2-0 fertilizer to one, 10-0-4 to another, and acid phosphate to the remaining one. This gave opportunities for comparing the varieties to one another, both fertilized and unfertilized. The varieties of cotton used were Triumph, King, South Missouri and native Louisiana.

The land was thoroughly prepared and the seed planted April 10th. On April 14th and 15th, just as the cotton was beginning to come up, a light frost injured the stand materially. The subsequent replant did not come up as well as was desired.

Although the rainfall was excessive all through the growing season, Mr. Byram succeeded in giving the crop good cultivation.

The rate at which the different varieties matured and the production per acre, can be most clearly set forth in tabular form, as seen in the following table.

TABLE

SHOWING DATE AND NUMBER OF POUNDS SEED COTTON PER ACRE PICKED AT EACH PICKING, AND ALSO TOTAL YIELD PER ACRE, BATCHELOR EXPERIMENT.

Variety.	Dat planted.	Fertilizer used.*	Date 1st picking.	Seed cotton per acre 1st picking.	Date 2nd picking.	Seed cotton per acre 2nd picking.	Date 3rd picking.	Seed cotton per acre 3rd picking.	Date 4th picking.	Seed cotton per acre 4th picking.	Total yield per acre.
Triumph	Apr. 10	None	Sept. 4	269 lbs.	Oct. 11	923 lbs.	Dec. 15	417 lbs.			1609 lbs.
"	" 10	Ac. Phos.	" 4	422 "	" 8	900 "	" 15	202 "			1524 "
"	" 10	11-2-0	Aug. 29	133 "	Sept. 4	206 "	Sept. 27	735 "	Oct. 8	1143 lbs.	2217 "
"	" 10	10-0-4	" 29	130 "	" 4	170 "	Oct. 11	1190 "	Dec. 15	242 "	1732 "
Native	" 10	None	Sept. 4	266 "	Oct. 19	780 "	Dec. 15	524 "			1570 "
"	" 10	Ac. Phos.	" 4	54 "	" 10	850 "	" 15	420 "			1324 "
"	" 10	11-2-0	" 4	304 "	" 10	327 "	Oct. 19	398 "	Dec. 15	567 lbs.	1596 "
"	" 10	10-0-4	" 4	204 "	" 19	625 "	Dec. 15	469 "			1298 "
South Missouri	" 10	None	Aug. 28	749 "	Sept. 22	490 "	Oct. 10	863 "			2102 "
" "	" 10	Ac. Phos.	" 28	794 "	" 22	588 "	Dec. 15	204 "			1586 "
" "	" 10	11-2-0	" 28	786 "	" 22	569 "	" 15	189 "			1544 "
" "	" 10	10-0-4	" 28	688 "	" 22	735 "	" 15	200 "			1623 "
King	" 10	None	" 29	580 "	" 22	430 "	Oct. 8	490 "	Dec. 15	350 lbs.	1850 "
"	" 10	Ac. Phos.	" 29	615 "	" 22	542 "	Dec. 15	148 "			1305 "
"	" 10	11-2-0	" 29	513 "	" 15	372 "	" 15	753 "			1638 "
"	" 10	10-0-4	" 29	582 "	Oct. 8	1070 "	" 15	146 "			1798 "

*Wherever fertilizer was used, it was at the rate of 300 lbs. per acre.

From the foregoing table it will be noted that Triumph gave the largest yield. This was rather surprising, as the stand of this variety was the poorest of all. The South Missouri came second in yield with King third. This is especially gratifying, as Triumph staple is considered more satisfactory than either the King or that of the cotton grown from southern Missouri seed ("South Missouri"). The only disadvantage which Triumph cotton appears to have for use in boll weevil infested sections lies in its rather dense and heavy foliage. Excessive shading of the ground caused by cottons having dense foliage, is conducive to a large percentage of the weevils in fallen squares reaching maturity. Further tests of this variety on the bottom lands of both the Red River and Mississippi Valleys, in localities where the weevils are abundant, will be necessary before we can reach a decision as to whether Triumph possesses enough advantages* in the way of early maturity, productiveness and quality of staple to off-set this one undesirable character.

In the light of these experiments it appears that, upon the whole, Triumph is likely to prove more satisfactory in the weevil sections than any of the other varieties tested.

The table below shows a ready comparison between the yields of the different varieties, both fertilized and unfertilized, in the Batchelor experiment.

Variety.	Unfertilized.	Fertilized with 300 lbs. 11-2-0 per acre.	Fertilized with 300 lbs. acid phosphate per acre.	Fertilized with 300 lbs. 10-0-4 per acre.
Native	1570 lbs.	1596 lbs.	1324 lbs.	1298 lbs.
So. Mo	2102 lbs.	1544 lbs.	1586 lbs.	1623 lbs.
Triumph	1609 lbs.	2217 lbs.	1524 lbs.	1732 lbs.
King	1850 lbs.	1638 lbs.	1305 lbs.	1798 lbs.

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*Another advantage possessed by the Triumph variety is that it runs 38 per cent. lint, a higher percentage than most cottons.

SUMMARY.

1. In co-operation with the Bureau of Entomology, the Crop Pest Commission conducted cultural experiments at three points: in the heavily infested section of Logansport, in the lightly infested section at Alexandria and in the non-infested Mississippi Valley at Batchelor.

2. The early maturing varieties of cotton, Triumph, King and cotton from seed purchased in southern Missouri were grown for comparison with native Louisiana cotton at each of the three places.

3. In the experiment at Logansport, where boll weevils were exceptionally abundant, on good upland soil, the employment of the "cultural methods" resulted in a production of 1,155 pounds seed cotton per acre in the case of Triumph, 1,027 pounds in the case of King and 1,006 pounds in the case of "South Missouri," while the native cotton produced 948 pounds seed cotton per acre.

4. In the experiment at Alexandria, on a Red River Valley plantation, with fewer weevils present, all the varieties yielded in excess of a bale per acre, Triumph producing upwards of 2,200 pounds of seed cotton per acre.

5. In the experiment at Batchelor, Pointe Coupee Parish, on a Mississippi Valley plantation with no boll weevils present, Triumph produced 2,217, King 1,638, "South Missouri" 1,544, native fertilized 1,596, and native unfertilized 1,570 pounds of seed cotton to the acre.

6. The results point to Triumph as being the best all-round variety for use in boll weevil infested sections, followed closely by King and cotton grown from northern seed (south Missouri or northern Oklahoma).

7. Northern-grown seed, though producing an early maturing crop, does not retain its quality of earliness, and the seed must be renewed from northern points at least every two years.

8. The use of 200 to 300 pounds of fertilizer containing a high per cent of available phosphoric acid, in most cases hastened maturity. The increased yield, on the upland soils, was sufficient to pay several hundred per cent profit on the cost of the fertilizer.

RECOMMENDATIONS.

The results obtained in the foregoing experiments bear out and verify in a remarkable way, the recommendations contained in Circular No. 3 of the Crop Pest Commission, "The Cultural Remedy for the Boll Weevil," which was first published in November, 1905, and of which three editions were necessary to meet the demand of the farmers for it. But very little can be added to the recommendations made in that publication, and for a detailed discussion of the cultural methods the reader is advised to consult Circular No. 3, which can be secured by addressing the Commission at Baton Rouge.

Summarizing briefly the cultural methods in the light of the past year's experiments and observations, we advise:

Thorough Preparation of the Soil. The land should be well plowed and if necessary, gone over with the disc-harrow or drag, so that by planting time it will be loose, friable, and as near like a *garden seed bed* as possible. Too much emphasis cannot be placed upon the importance of doing this work *early* so that when the proper time for planting arrives, the latter work can proceed without delay. Fall and winter plowing should be practiced far more than it is, not only because winter plowing opens and aerates the soil, but because the winter plowing and cultivation breaks up and exposes the underground cells in which the boll worms (*not* boll weevils) pass the winter, resulting in their destruction by the action of the weather and by putting them on the surface where they can be picked up by the birds. A large part of the destruction with which the boll *weevil* has been charged has been done by the boll *worm,* hence the importance of practicing measures which will reduce the numbers of *both* insects.

"Splitting" the old cotton or corn rows and planting the cotton seed without the land being plowed, is a method so slipshod, slovenly and unprofitable that none but careless, indifferent farmers will practice it except under the force of dire necessity.

Early Planting. To produce an early-maturing crop, the seed must be planted early. We do not, however, advocate *extreme* early planting. Last year some few planters over-did the early planting idea and put in the seed at such an early date that the stand suffered severely from the cold and frosts. The seed should be planted so that the plants will be up by the time most of the danger of frost is over. It is better to incur a *slight* risk of frost injury than to delay planting too long, as the boll weevil damage to a late-planted crop will be much greater than the loss due to a frost injuring an early stand. No two seasons are alike, and certain soils "warm up" and are ready for the seed earlier than others, so that no hard and fast rule for the proper date of planting can be laid down. In deciding as to the proper date for planting, the individual planter has a fine opportunity to use his own judgment and experience. The nature of the soil, its drainage and the nature of the season must all be taken into account in deciding what constitutes the proper date for "early planting" on each farm.

The table below, showing the dates of latest killing frost and dates of latest light frost in different portions of the boll weevil infested territory, may prove of assistance in deciding upon the proper date for planting.

DATES OF LATEST KILLING FROSTS AND LATEST LIGHT FROSTS AT DIFFERENT POINTS FOR THE YEARS 1904, 1905 AND 1906.

(Compiled from records of the U. S. Weather Bureau.)

STATION.	1904		1905		1906	
	Latest killing frost.*	Latest light frost.	Latest killing frost.	Latest light frost.	Latest killing frost.	Latest light frost.
Alexandria	Mar. 5	Apr. 10	Feb. 26	Apr. 6	Mar. 29	Apr. 1
Cameron	Feb. 12	....	Feb. 16	....	....	....
Cheneyville	Feb. 13	Mar. 27	Feb. 22	....	Mar. 21	....
Jennings	Feb. 11	Mar. 27	Feb. 16	....	Feb. 6	....
Opelousas	Mar. 5	Apr. 10	Feb. 26	....	Mar. 21	Apr. 15
Plain Dealing	Apr. 10	....	Feb. 28	Apr. 16	....	Apr. 15
Robeline	Apr. 18	Apr. 10	Feb. 26	Mar. 30	Mar. 21	Apr. 16
Shreveport	Mar. 4	....	Feb. 16	....	Mar. 30	Apr. 1

Early Varieties of Cotton. In view of the past year's experience, Triumph seems to be slightly preferable to King or to cotton grown from northern seed. King still continues to be a valuable variety for use in the weevil sections, but does not possess any material advantage over the cotton produced from seed purchased in southern Missouri or northern Oklahoma. Rowden is being used by many planters and quite a number of the planters prefer this variety to King. Parker cotton has given excellent results in Texas, but for some unknown reason the Louisiana planters seem not to have adopted it.*

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*"Latest killing frost" has reference to latest date of a killing frost, heavy frost or ice.

Use of Fertilizers. The past year's experience in the boll weevil section has demonstrated more forcibly than ever before the advantages resulting from the judicious use of fertilizers in producing an early-maturing crop. Phosphoric acid more than any other plant food seems to be the prime factor in bringing about early maturity. On upland soils the increased yield due to the use of fertilizers has been uniform and striking and has hastened maturity and increased the yield to such an extent as to render the investment in the fertilizer a highly profitable one. In this connection, the cotton planter should not fail to read carefully the comprehensive article on cotton fertilizers by Prof. W. R. Dodson, which appears on pages 12 to 15 of Crop Pest Commission Circular No. 3 (revised edition of March, 1906).†

Thorough Cultivation. The prime object of cultivation is to render the soil suitable and favorable for the most rapid development of the plants growing upon it. Good cultivation conserves soil moisture, admits air to the soil and renders the plant food more readily available for the crop. It stands to reason, therefore, that the more thorough the cultivation the more rapid will be the growth and maturing of the crop. This is exactly what occurs in practice and a cultivation which is only sufficient to "keep down the grass" is not the kind of cultivation that will produce a profitable early crop of cotton. The cotton plant requires a shallow, rather than a deep cultivation. Mr. Bland, in the Logansport experiment, obtained his excellent results with nine *shallow* cultivations—not a single *deep* cultivation was given the crop. Throughout the entire growing season, or until the crop is "laid by," the attempt should always be to keep the surface soil thoroughly pulverized, constantly stirred and in the condition of a "dust mulch" as nearly as possible. The ground should not be allowed to cake, or the surface to become hard after rains. (Note the finely pulverized soil between the rows of the fields shown in Figures 1 and 2.)

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*Hon. L. S. Frierson, on the other hand, reports that he has not had satisfactory results with this variety the past season, on his plantation near Frierson, La.

†Those of our readers who have not a copy of Circular No. 3 at hand can secure it by addressing the Secretary of the Crop Pest Commission, Baton Rouge, La.

Fall Destruction of the Cotton Plants. The early fall destruction of the cotton plants is the only step involved in the cultural remedy which actually *destroys the boll weevils themselves.* Its importance must not therefore be overlooked. That the stalks *can be* destroyed in the fall was amply shown in the case of the experiment at Logansport, where the cotton was not only open, but was all actually *picked out* by the 23rd of October. If all the cotton plants in the State were uprooted and burned before the 25th of October each year, it is quite safe to predict that the boll weevil would be a pest of but little consequence.

Another reason why the plants should be destroyed in the autumn and the ground plowed immediately afterwards—a new and most vital reason—has recently come to light. In the experiments and observations made on the hibernating habits of the boll weevil at Keachie, La., during the winter of 1905-06, we found, very much to our surprise, that a grassy cotton field with the stalks left standing, gave the weevils the best protection through the winter of all situations. It is in the grassy, weedy, unplowed cotton fields that a larger per cent of the weevils successfully pass the winter than anywhere else, the woods and forests not even excepted. Could there be any stronger argument for picking out the cotton early, destroying the plants and then plowing the ground deeply, thus taking from the pest its principal winter stronghold?

"IF YOU DON'T SEE WHAT YOU WANT, ASK FOR IT."

If there is anything in the preceding pages that has been explained to your satisfaction, if there is some particu phase of the "cultural method" of fighting the boll weevil t is not clear to you, write to the State Crop Pest Commiss about it.

Or perhaps there is some insect injuring your crops ot than cotton, or possibly your fruit trees are not doing as w as they should for some unknown reason. If such be the ca write us fully about it and we may be able to help you.

That's our *business*—answering common sense questio from sensible, far-sighted farmers, cheerfully, to the best of ability and always free of cost to you.

State Crop Pest Commission
OF LOUISIANA.

CIRCULAR No. 12. March, 1907.

The Circulars of the State Crop Pest Commission are sent free of charge to l farmers and fruit growers of Louisiana who make application therefor.

REPORT ON THE NURSERY INSPECTION WORK OF THE STATE CROP PEST COMMISSION FOR THE SEASON OF 1906-07.

BY WILMON NEWELL AND ARTHUR H. ROSENFELD.

One of the most important lines of work conducted by the Crop Pest Commission is that of preventing the introduction of dangerous insect pests into the orchards of our commercial fruit growers and farmers. Nursery stock is the vehicle upon which the majority of our worst fruit enemies obtain access to the orchard, and the importance of having the nurseries free of disease and deadly insect enemies must be self-evident to every thinking fruit grower.

The present report upon the nursery inspection work conducted during the past year is submitted for the joint purpose of familiarizing the fruit growers with what is being accomplished for their protection and placing in their hands information which will enable them to the more thoroughly co-operate with the Commission in protecting themselves and incidentally the State's important fruit interests.

As the present paper is the first report made upon this branch of our work, it may not be out of place to first explain, briefly, the purpose and objects of the Commission's regulations governing the sale and shipment of nursery stock in Louisiana.

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The State Crop Pest Commission was established by the Ext Session of the Legislature of 1903, and in March, 1905, the nu ery inspection regulations were put into effect. Louisiana w very late in securing this protection, and had already suffer severely from her lack of it. Unscrupulous nurserymen in ma states, which already had inspection laws, when they found th could not legally sell diseased and insect-infested stock in th own states, shipped it at bargain prices to those states not ha ing such laws. Our State received many thousands of th sorts of trees, and a great many species of injurious insects a diseases entered Louisiana, which might have been prevent from coming in had our State Crop Pest Commission, or som thing of the same nature, been established sooner. Besides sa dling our orchardists with all these inferior trees, the lack of nursery inspection law also greatly handicapped the nurserym of our State. On account of lack of inspection and certificati by a competent entomologist, our nurserymen were prevent from shipping into many states from which they might have be drawing a splendid revenue.

Since the adoption of the Commission regulations gover ing the sale and shipment of nursery stock, however, nurse conditions have changed greatly in Louisiana, our nurserym now being able to ship anywhere they wish, and our fruit gro ers getting stock in much better condition than formerly. can best illustrate this improvement of conditions by compari our first year's work with that of the current season—the seco inspection season.

This season we have inspected fifty-five nurseries—ju twenty-seven more than were inspected last season, or lacki just one of being twice as many. Here in itself is indicated a cided improvement. In the case of sixteen out of this fifty-fi San Jose scale was found either in the nurseries themselves or close as to endanger the nursery stock by spreading, while ch scale on orange was found in one. To date all except five nu erymen have followed the directions of the Commission a have succeeded in eradicating the scale from their premis In the case of the delinquent five, certificates of inspecti have been refused until the premises are thoroughly cleaned kept under quarantine a sufficient time, then reinspected, a ounced apparently free of scale by the inspector. Fifty ficates of inspection have been issued—nearly twice the ber issued last season.

The names and addresses of the Louisiana nurserymen hold-valid certificates are given in a table on a subsequent page, to this table the reader is referred for further details re-ling the amount and kind of stock grown by each nursery-.

Since this inspection system was inaugurated in the season 905-06 the amount of nursery stock grown in the State has eased almost four hundred per cent. Last season the in-tors of the Commission examined 683,550 growing market- trees and shrubs, whereas this season the number has been eased to 2, 207,319.

On the whole the status of the nursery business of the State ost encouraging. The extraordinary increase of salable stock he one season, the increased number of nurseries inspected, the diminution in percentage of nurseries infested, all point he fact that the protection and assistance given by the Com-sion to both buyers and sellers of nursery stock, has had the ct of materially stimulating the State's fruit industries.

THE NURSERY INSPECTION REGULATIONS.

The provisions of the nursery inspection regulations are in ef as follows: Every nursery doing business in the State st be inspected at least once each year, and, if found appar-ly free of dangerously injurious insects and plant diseases, nurseryman is granted a certificate of inspection which en-es him to do business until the first of the following ly, on which date the nursery inspection season ends each r. Copies of this certificate of inspection are printed upon linary shipping tags, and at least one of these tags must be ached to every bundle, bale, or package of nursery stock pped or delivered within the State. As regards outside rserymen shipping into Louisiana, certificates of inspection m the State Entomologists of their states are accepted in lieu our tags.

These tags, besides being a great protection to both buyers d sellers of nursery stock, are also a great advertisement for [illegible] as their presence upon a [illegible] the best possible indication that [illegible] is apparently free from the [illegible] and plant diseases of which [illegible]

[illegible] manner of paying for this inspe [illegible] is that in a good many other [illegible] law a fine to the nurseryman. [illegible], resident or non-resident, has t [illegible] privilege of doing business in the S [illegible] have to pay actual cost to the State [illegible] in Michigan, besides a license [illegible] must give bond for a thou [illegible] that no stock will be sold unless [illegible] State also requires the depositio [illegible] of one thousand dollars.

[illegible] only expense to which a Louisian [illegible] nursery inspection law, is the very [illegible] the certificate of inspection printe [illegible] themselves being paid for by the [illegible] nursery stock shipped within or deli [illegible] must be defoliated. The regula [illegible] white fly, the larvæ of which occur [illegible] is that by defoliation the amount [illegible] reduced to a minimum.

[illegible] insects and plant diseases declare [illegible] injurious to fruits are the [illegible] scale, cottony cushion scale, W [illegible] woolly aphis, white fly, crown g [illegible] black knot, and the Commission [illegible] to add to or amend this list [illegible] the State require it.

THE SAN JOSE SCA

[illegible] is the insect which above all ot [illegible] inspection laws and regulation [illegible] States. It was first introduced i [illegible] about 1870, the point of introdu [illegible] gave it its common name. From thi it has spread almost incredibly, until now every fruit-growing state in the Union is more or less badly infested. It was first discovered in the East at Charlottesville, Va., in 1893, and although heroic measures for its extermination were taken by both the State and National Governments, their efforts were unavailing, and the pest continued its march of destruction, leaving trouble and discouragement in its wake. The San Jose scale is now a permanent factor in our orchard and nursery work, and, while we have now learned to control it quite easily in the orchard, its presence in a nursery still causes a great deal of trouble.

Many of this family of scale insects are notably injurious on account of their peculiar anatomy and habits. They cannot be poisoned because they obtain their sustenance by inserting their long, thin beaks into the tissues of the plant, and sucking the sap. All insects which feed in this manner are more difficult to control than insects feeding on the outer tissues of a plant. The question of controlling the San Jose scale, therefore, naturally resolves itself into the use of "contact insecticides," substances which, when made to touch the insects, by corroding the essential body tissues of the animal or by exerting a smothering effect, cause death. Here again the question is complicated because the insect is wholly covered during almost its entire existence, by a waxy scale, which is very resistant to almost all ordinary "contact insecticides." By many years of work, however, the wash known as the lime-sulphur wash has been developed to a high point of efficiency, and is almost universally used in controlling the San Jose scale in orchards. When it is found in a nursery, however, or very close to one, destruction of all infested plants is insisted on. Even though we can kill almost all of the insects by spraying with the lime-sulphur wash, we cannot totally eradicate them, which is the object sought in case of a nursery infestation.

We will not occupy any more space with the description of this insect, except to mention one particular peculiarity. This lies in the manner of reproduction; instead of laying eggs as most insects do, the female San Jose scale brings forth its young alive. Circular No. 4 of the Commission, which fully describes the insect and treatment for it, can be had, postage prepaid, by applying to Wilmon Newell, Secretary, Baton Rouge, La.

the nurserymen, as their presence upon a nurseryman's shi ments are the best possible indication that the stock to whi they are attached is apparently free from the dangerously inj rious insects and plant diseases of which fruit growers are much afraid.

The manner of paying for this inspection in Louisiana far superior to that in a good many other states, inasmuch th everything here is free to the nurseryman. In Virginia, eve nurseryman, resident or non-resident, has to pay twenty doll for the privilege of doing business in the State, in Illinois nu erymen have to pay actual cost to the State for inspecting th places, and in Michigan, besides a license fee of five dolla each nurseryman must give bond for a thousand dollars with t condition that no stock will be sold unless inspected and fun gated. Idaho also requires the deposition of a bond to t amount of one thousand dollars.

The only expense to which a Louisiana nurseryman is p by the nursery inspection law, is the very nominal one of havi copies of his certificate of inspection printed upon shipping ta the tags themselves being paid for by the Commission.

All citrus stock shipped within or delivered in the State Louisiana must be defoliated. The regulation is aimed direc at the white fly, the larvæ of which occur only on the leaves its host, so that by defoliation the amount of white fly infest stock is reduced to a minimum.

The insects and plant diseases declared by the Commissi to be dangerously injurious to fruits are the San Jose scale, nem tode root knot, cottony cushion scale, West Indian peach sca chaff scale, woolly aphis, white fly, crown gall and hairy root d eases, and black knot; and the Commission is empowered by la with authority to add to or extend this list at any time the int ests of the State require it.

THE SAN JOSE SCALE.

This is the insect which above all others is responsible f the nursery inspection laws and regulations in nearly every sta in the Union. It was first introduced into this country fro China, about 1870, the point of introduction being San Jos Cal., hence its common name. From this center of infestati has spread almost incredibly, until now every fruit-growing te in the Union is more or less badly infested. It was first covered in the East at Charlottesville, Va., in 1893, and hough heroic measures for its extermination were taken by h the State and National Governments, their efforts were un- ailing, and the pest continued its march of destruction, leaving uble and discouragement in its wake. The San Jose scale is w a permanent factor in our orchard and nursery work, and, ile we have now learned to control it quite easily in the or- ard, its presence in a nursery still causes a great deal of uble.

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NEMATODE ROOT KNOT.

These knots are not caused by real insects, but by littl worms belonging to another group of animals. They sometim do quite a little damage on roots of plants, causing numero wart-like swellings or galls. When these animals are found i a nursery, the nurserymen are to destroy all trees found infeste with this parasite when the trees are being dug.

COTTONY CUSHION SCALE.

The cottony cushion scale is another one of the scale inse family, but, fortunately, one which we have not yet with u It is known in the United States in California and Florida. Th insect is to citrus trees what the San Jose scale is to deciduo trees. It is a much larger insect than the San Jose scale, whit and with the wax arranged in a peculiar fluted manner, sugges ing the common name of fluted scale. As in the case of th San Jose scale, it is a foreign insect, and the point of introdu tion into this country was California. About 1868 or 1869 believed to be the date of its introduction. It soon attracte widespread attention and for a while it was thought that th culture of oranges and lemons in California would have to forsaken. However, in 1888, Mr. Alfred Koebele, an entomol gist, was sent to Australia to study the natural enemies of thi insect, as in its own home it seemed to be held in check by som natural enemy. Fortunately for California, and probably fo the rest of the orange-growing states as well, Mr. Koebele su ceeded in finding the insect which kept the cottony cushion scal from being injurious to any large extent in Australia. Thi insect was a little ladybird beetle predaceous on the cotton cushion scale. Mr. Koebele succeeded in importing a goodl number of these beetles to California, and in a few years th danger from the cottony cushion or fluted scale had been don away with. The scale afterwards got into Florida, and was deal with in the same way. It still exists in both states, but wheneve it becomes markedly injurious in a locality, the introduction of few of these ladybirds soon brings it under control.

WEST INDIAN PEACH SCALE.

This is a white scale insect, which sometimes does a great al of damage to peach and plum trees, and which as yet is stricted in Louisiana to a few localities. It was first introduced to this country from the West Indies, as may be judged from s name. When it is found in or near a nursery, its eradication insisted on before a certificate of inspection is granted the rseryman.

WOOLLY APHIS.

The woolly aphis is a soft-bodied plant louse, which lives on pple trees. It lives both above and below the ground, but the orm on the roots is the most dangerous, because harder to treat. t excretes a white, fluffy substance, looking very much like wool, hich substance gives it its common name. It causes galls on he roots of the trees very much like those of the nematode oot worms. When these insects are found in a nursery, the ame measures are enforced as against the nematode root knot.

WHITE FLY.

White flies are among our most common and most injurious insects on citrus trees, cape jasmine, *Ligustrum*, etc. In the younger stages they look very much like scale insects, but belong to an allied family. The larvæ are found on the under side of the leaves as small, oval, whitish, scale-like bodies, which have the faculty of exuding a sweet substance called honey-dew. Certain plant organisms, known as fungi, grow in this honey-dew, and give rise to the black or smutty appearance so common on oranges and cape jasmine in this State. To prevent the spreading of this insect to the portions of the State not yet infested, the regulations of the Commission require all citrus nursery stock to be defoliated before shipment is made.

A comprehensive article upon the habits of the white fly, and its control, has been prepared and copies may be had on application to the Secretary of the Commission at Baton Rouge.

LIST OF LOUISIANA

SEASON OF

NAME AND ADDRESS OF OWNER.	NAME OF NURSERY.
Abele Bros., 520 Joseph St., New Orleans	
Alost, A., Box 39, French Market, New Orleans	Rose Villa
Bayhi, Theodore, Naomi	
Bechnel, Benjimin, Naomi	
Becker, F. X., Rampart and Lesseps Sts., New Orleans	
Bourgeois, Paul, Central	
Chauvin, Frank, Convent	
Chopin, Peter A., Magazine and 8th Sts., New Orleans	
Clingman Nursery & Orchard Co., Keithville	
Cook's Sons, M., 7400 St. Charles Ave., New Orleans	
Copeland, J. D., Taylor Station	
Delee, John, Teddy	
DeLimon, H., Metairie Ridge, New Orleans	Metairie Nursery
Eble, Chas., 106 Baronne st., New Orleans	
**Eichling, C. W. 3442 St. Charles Ave., New Orleans	
Galbreath, D., Box 1249, New Orleans	
Glasscock, Burrel J., Leesville	
**Heroman, F. W., Baton Rouge	
Hewett Bros., Hammond	
Higgins, Hardy, (col.), Naomi	
Holst, C., opposite Greenwood Cemetery, New Orleans	Magnolia Nurseries
Huskamp, D., 3301 St. Claude St., New Orleans	
James, S. H., Mounds	
Keep & Nelson, Station B, New Orleans	
Lacy, T. J. & Co., Lafayette	Eureka Nurseries
Lee, J. D., 608-610 Milam St., Shreveport	
McCausland, Wm., Baton Rouge	
McMullen, Mrs. Joe, Stonewall	
Metairie Ridge Nursery Co., Metairie Ridge, New Orleans	
Moizant, Alfred, Buras	
Monkhouse, John, Jewella	Caddo Nurseries
Moore, R. S., Naomi	Riverside Orange Grove an Nurseries
Munday, Mrs. S. E., Clinton	

URSERYMEN.

06-1907.

CERTIFICATE NO.	KIND OF STOCK	NUMBER OF TREES OR PLANTS
29	Ornamental	4,000
46	Ornamental	15,250
20	Orange	150
15	Orange	3,000
40	Ornamental	3,636
13	Pecan	700
12	Pecan	49
37	Ornamental	1,000
4	General Nursery	338,600*
24	Citrus and ornamental	4,900
9	Fruit	10,400
34	Fruit	2,000
26	Citrus and ornamental	27,680
50	Ornamental	1,220
28	Ornamental	
38	Pecan and orange	4,200
49	General nursery	2,550
39	Dealer in general nursery stock	
11	Pecan, fig and ornamental	112,800
31	Orange	3,000
44	Ornamental	3,118
36	Ornamental	3,061
8	Pecan	7,000
22	Pecan, fruit and ornamental	9,500
17	General nursery	10,553
5	Pecan	400
42	Fig	25
7	Apple	1,000
27	Citrus and ornamental	42,850
30	Orange	800
10	General nursery	65,062
14	Orange	10,000
35	*Camelia japonica*	500

NAME AND ADDRESS OF OWNER.	NAME OF NURSERY.
Newsham, J. A., Nashville Ave. and Pitt St., New Orleans	Nashville Avenue Rose Gard's
Normand, J. L., Marksville	Hill Side Nursery
Otis, C. D., Lake Charles	Lake Charles Greenhouse and Nursery
Quinette, F. A., Station B, New Orleans	
Randolph, M. L., Bayou Goula	
Reith, Frank, Jr., St. Andrew and Camp Sts., New Orleans	
Robinson, B. F., Ruston	Ruston Nursery
Sanders, Leon, Plain Dealing	Louisiana Star Nurseries
St. Mard, J., Delachaise and Saratoga Sts., New Orleans	Saratoga Nurseries
**Schindler, Jos. A. & Co., 827 Decatur St., New Orleans	
See, John, 630 Bartholomew St., New Orleans	
Shadow, W. R., Mansfield	Louisiana Nursery Co.
Steckler, J., Seed Co., Ltd., 516 Gravier st., New Orleans	
Stokes, Samuel and Son, Lecompte	
Virgin, U. J., 838 Canal St., New Orleans	
Wicheos, B. M., Gretna	
Wright, Charles (col.), Lake Charles	
TOTAL, 50 Nurseries.	

**Dealers in nursery stock only. Buy only from nurseries in which conditions are known to, and approved by, the State Crop Pest Commission.

CERTIFICATE NO.	KIND OF STOCK	NUMBER OF TREES OR PLANTS
25	Citrus and ornamental	26,050
3	Fruit and ornamental	4,005
18	General nursery	1,778
23	Pecan, Citrus and ornamental	12,100
21	Pecan	500
47	Ornamental	3,000
6	General nursery	15,900
16	Fruit	28,000
48	Rosebushes	12,000
45	Dealers in general nursery stock	
33	Ornamental	500
2	General nursery	1,398,000
32	General nursery	265
1	Ornamental	14,300
41	Ornamental	1,750
43	Citrus and ornamental	90
19	Citrus and ornamental	77
	TOTAL	2,207,319

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*This is really the largest nursery in the State, but the inspector failed to list ornamental stock, etc. The amount of nursery stock grown here is probably in the neighborhood of a million and a half plants.

In the above list, under "Number of plants" is given only what is known as "nursery stock," i. e., such plants as fruit trees, Cape Jasmine, field-grown rose bushes, *Ficus,* etc., which are salable. Greenhouse plants are not counted as nursery stock, hence the small amount of stock listed for some of the growers of ornamental stock.

24 ☒

State Crop Pest Commission
OF LOUISIANA.

CIRCULAR NO. 13. April, 1907.

The Circulars of the State Crop Pest Commission are sent free of charge to all farmers and fruit growers of Louisiana who make application therefor.

REPORT

UPON

THE WORK OF THE STATE CROP PEST COMMISSION*

By WILMON NEWELL, Secretary and Entomologist.

Since the last meeting of this Commission, held September 25, 1906, a considerable number of changes in the working staff has been made necessary by our inability, owing to lack of appropriation by the last Legislature, to pay salaries sufficiently large to induce competent men familiar with Southern conditions to remain in our employ. The practical training which assistants and inspectors obtain in the somewhat strenuous work conducted by the Commission makes them valuable men for other States and for other institutions doing similar work.

The lack of funds has also compelled the entire abandonment of important work and investigation along some lines, and has greatly hampered and restricted our work in every direction. I should like to review for you, briefly, the work that has been under way, and outline for you our present undertakings and the plans of work for this season.

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*Read before the Commission, at its meeting held at Baton Rouge., La. April 11, 1907.

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OFFICE WORK AND CORRESPONDENCE.

The letters received from planters and fruit grower throughout the State continue to increase. The fact that th past winter has been very mild and is being followed by a seaso favorable to the increase of insects, points to the present seaso as being one in which insect damage in Louisiana will excee that of any season for many years past.

At the present time we have in our files letters from 2,75 different parties, the bulk of them being bona fide farmers. O our mailing list we have the names of approximately 8,00 Louisiana farmers who receive our publications as they ar issued. For several months past the correspondence, and offic work incident thereto, has been far greater than the one stenographer could attend to and from one to two of the assistan entomologists had to be employed for the major part of thei time in answering letters. The congestion of correspondenc became so great about the middle of last month that an additiona stenographer was employed upon the authorization of the Activ Chairman.

Our expenditures for postage on letters and bulletins no average upwards of $75.00 per month.

PUBLICATION OF "CIRCULARS."

Since the last meeting, two bulletins have been published as follows:

Circular No. 10, November, 1906, upon "The Cattle Tick," was printed in an edition of 15,000 copies, most of which hav already been distributed to farmers on our mailing list, and t others through business houses, farmers' meetings, etc. Thi Circular gave the results of studies made of the life history o the tick by the Commission since August 1, 1905, containe practical recommendations for ridding cattle and pastures o the ticks by rotation methods based upon the experimental work and pointed out the advantages sure to follow tick eradicatio

Circular No. 11, January, 1907, gave the results of th cultural experiments conducted against the boll weevil durin 1906, in co-operation with the Bureau of Entomology of th

nited States Department of Agriculture. The results obtained
these experiments were most gratifying, and they thoroughly
emonstrated the efficiency of the cultural methods when prop-
rly applied. Copies of these two circulars are before you.*

EXHIBITS AT STATE AND PARISH FAIRS.

At the State Fair at Shreveport, held November 17 to 28,
906, the Commission installed an exhibit illustrating the princi-
al injurious insects of the State and the measures to be used
n preventing damage by them or in controlling them. The
xhibit occupied 800 square feet of floor space and consisted of
bout 50 large photographs, glass cases of insects, spray pumps,
otton plants taken from our experimental fields in the boll weevil infested section, etc. A model of a small farm, illustrating the pasture rotation method of eradicating the cattle tick, attracted much attention, as did also the exhibit of live ticks engaged in egg-laying. Bulletins and other literature, contributed both by the Commission and the United States Department of Agriculture, were distributed to all farmers who desired them. Registers were kept in the exhibit space, where the visiting farmers and fruit growers registered, their names afterwards being placed on the permanent mailing list of the Commission. A table devoted to implements used in modern methods of bee-keeping also attracted much attention.

Besides the exhibit at the State Fair, somewhat less pretentious exhibits were displayed by the Commission at the Parish Fairs of Avoyelles, Webster and Bienville Parishes. One or more assistant entomologists were in charge of these exhibits, explaining methods used in fighting various insects, answering questions, distributing literature, etc.

It is certain that the good accomplished by these exhibits in educating the farmers in the control of their worst enemies far more than repays the State for the slight expense involved, and I urge that similar exhibits be made this year at as many of the parish fairs as possible.

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*Circulars 10 and 11 will be sent free to any farmer requesting them, upon application being made to Wilmon Newell, Secretary, Baton Rouge, La.

STEREOPTICON LECTURES.

During the past year a good stereopticon, or magic lanter has been secured, and is now used for illustrating insects an methods of control before meetings of farmers, fruit grower etc. A considerable number of interesting lantern slides ha been obtained by purchase, while many others have been ma in our own laboratory at Baton Rouge, so that we now ha several hundred slides, from which selections can be made f illustrating almost any phase of insect warfare. During t past few months the entomologist and his assistants have giv stereopticon lectures at a number of towns, among them bei New Orleans, Calhoun, Lake Charles, Marksville and Mari gouin. It will be our policy from now on to furnish lectur and lantern free of charge to farmers' meetings and associatio anywhere in the State whenever requested to do so.

CO-OPERATION WITH THE BUREAU OF ENTOMOLOG

In accordance with the plans arranged at the beginning the fiscal year, July 1, 1906, the boll weevil investigation wo has been conducted in co-operation with the Bureau of Ent mology, Dr. L. O. Howard and Dr. W. D. Hunter having a signed three Special Field Agents to duty in Louisiana in th work, the salaries and traveling expenses of these field agen being paid by the Bureau.

Cultural experiments were conducted at Logansport, Batc elor and Willow Glen during 1906, the results of which a given in Circular 11. Other experiments were conducted Vernon and Calcasieu Parishes to test the merits of a somewh generally established theory to the effect that late planting cotton would prevent damage by the boll weevil. The resul of these experiments, while negative, demonstrated the utt impracticability of such a scheme. The full report on the experiments,* as well as the report upon similar experimen conducted by the Bureau of Entomology in Texas,† I have he for your reference.

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*This report will shortly be printed and distributed to the parties upon the Co mission's mailing list.

†Will appear in the Yearbook of the U. S. Dept. of Agriculture for 1906.

On Feb. 28th, 1907, Mr. J. B. Garrett, one of the Field ents assigned by the Bureau to work with the Commission, dered his resignation in order to accept a position at the rth Louisiana Experiment Station. After some delay, Mr. rence E. Hood, of Amherst, Mass., was appointed by the reau to succeed Mr. Garrett.

Upon April 1st, Mr. C. W. Flynn, who was also a special eld Agent of the Bureau of Entomology, resigned his position such to take charge of actual field work for the Commission the work of cattle tick eradication. Mr. T. C. Paulsen, of ton Rouge, has been appointed by the Honorable Secretary Agriculture to fill out Mr. Flynn's unexpired term, until ne 30, 1907.

On account of the congressional appropriation for boll eevil investigations having been much reduced by the last ongress, the Bureau of Entomology will not be able to assign ore than two men to the investigation work in Louisiana during e coming fiscal year, which commences on July 1.

In co-operation with the Bureau of Entomology, we have ade plans for cultural experiments at Mansfield and at Marksille, La., the prime object in both cases being to test the cultural emedy for the boll weevil under local conditions and upon ifferent soils, and also to give planters in these sections an pportunity to actually visit the experimental fields and note he methods employed.

A new line of work in connection with the weevil investiga- ion is being undertaken. This is a study of the different species f insects which prey upon, or are parasitic upon, the boll weevil, r which are manifesting a tendency to acquire a taste for the veevil. Preliminary investigations of this subject already made y Dr. Hunter in Texas have revealed a number of natural nemies of the weevil which can without doubt be artificially ncreased and so distributed that each of the natural enemies shall be disseminated over the entire weevil infested territory. This is an attempt to utilize Nature's own forces and methods in solving the problem, and I incline to the opinion that in this direction will be found the ultimate satisfactory solution of the boll weevil problem.

ORGANIZATION OF WORKING STAFF.

On Feb. 28, 1907, Mr. Harper Dean, Jr., Assistant Entomologist, resigned his position to accept a better-paying position in Virginia. Upon the authorization of the Active Chairman. Mr. G. A. Runner, of Columbus, Ohio, was appointed as his successor. Mr. Runner is expected to report for duty about April 15th.

Having under consideration the main lines of work to be conducted this season, and the men available, your Secretary would recommend the following plan of work and organization of working force:

Boll weevil investigation, to be conducted by Messrs. C. E. Hood, T. C. Paulsen and Wilmon Newell, as Special Field Agents of the Bureau of Entomology.

Field work in cattle tick eradication, in co-operation with the State Experiment Stations and Bureau of Animal Industry, to be in charge of Mr. C. W. Flynn, Assistant Entomologist, assisted by such inspectors as may be needed as the work develops, and as funds may be secured for their employment.

Nursery and orchard inspection work, to be conducted under the general supervision of Mr. Arthur H. Rosenfeld, assisted by Mr. G. A. Runner, the latter gentleman to do the bulk of actual inspection work, Mr. Rosenfeld to also have charge of exhibits at Parish and State Fairs, to attend to correspondence and work relating to fruit insects, and to serve as office and laboratory assistant to the Secretary.

Investigation of life history of the cattle tick, experiments with parasiticides, sprays, dips, etc., for the cattle tick, to be conducted by M. S. Dougherty, assisted by one untrained helper. who will construct cages, make photographs and do general mechanical and routine work.

Bookkeeping, clerical work and stenographic work, to be done by Miss L. E. Renneker and Miss C. J. Renneker, stenographers.

HORSE FLY INVESTIGATION.

During the summer of 1906, Mr. Jas. S. Hine continued his investigation of the horse fly nuisance in Louisiana and added much to our knowledge of the life histories and habits of these ests and their natural enemies. Mr. Hine's report upon his nvestigations for the past year has been submitted to the Secreary, and is a valuable scientific work, but on account of our resent shortage of funds the Secretary has some hesitancy in rdering same printed.

The horse fly investigation, while of great importance to he live stock interests, will have to be suspended for lack of noney to carry on the work.

CIRCULARS AWAITING PUBLICATION.

The Secretary and his assistants have manuscripts ready for publication upon a variety of important subjects relative to the injurious insects of the State, but for lack of funds they cannot at present be issued. Among these may be mentioned the following:

"Report upon Experiments in the Late Planting of Cotton, with a View to Averting Damage by the Boll Weevil."

"The White Fly of the Orange and Its Treatment."

"Second Report upon the Horseflies of Louisiana."

"The Use of Carbon Bisulphide for the Destruction of Garden and Household Insects."

"Control of the Peach Tree Borer."

"Methods for Destroying Ants, and Preventing Damage by Them."

"The Sweet Potato Weevil."

In addition to these, accumulated notes and results will shortly enable us to have ready other papers of immediate practical importance.

NURSERY AND ORCHARD INSPECTION WORK.

I am pleased to report that the work of the Commission in the inspection of nurseries and in protecting fruit growers by prohibiting the sale of trees infested with San Jose scale and other dangerous insects, has been highly appreciated over the entire State. The San Jose scale has been completely eradicated from several important nurseries where it had obtained a foothold, and under the protection given by the Commission's regulations increased investments in orchards have been made in many localities. During the past year the nursery business of the State has increased almost 400 per cent. During the current season we have inspected 2,207,300 trees and plants intended for sale, as against the inspection of but 683,500 during the year previous. During the current season also we have issued "health certificates" to 50 nurseries within the State, as against certificates issued to 27 nurseries during the previous season.

We have every reason to believe that this increase in the fruit growing industries has been due largely, if not entirely, to the protection against deadly enemies which has been afforded the growers by the Crop Pest Commission. The express and railroad companies have given us their full support in enforcing the regulations governing the shipment of nursery stock, and we believe our inspection system to be now so thoroughly organized and effective that it is almost impossible for a Louisiana farmer to purchase a fruit tree infested with any dangerous insect or disease.

FIGHTING THE WHITE FLY OF THE ORANGE.

In the spring of 1906 we attempted the introduction of the so-called "red-pink fungus" into Louisiana orange groves. This fungus destroys the white fly of the orange, and is therefore highly beneficial. I am pleased to report that despite the fact that a severe drought made conditions very unfavorable for this attempt last spring, we succeeded in getting this beneficial fungus well established at Lake Charles, La., and on the trees where it is at work upwards of 95 per cent of the white flies on the trees were killed during the winter. We are now attempting to get this same fungus established in the orange groves in Jefferson and Orleans Parishes, and as material is available, we hope to establish it in all of the principal orange growing parishes of the State.

An extensive series of spraying experiments upon orange trees was begun at the Audubon Park Experiment Station during January and February, 1907. Various formulae and sprays were tested for the purple scale, white fly and other insect enemies of citrus fruits. While our observations on these experiments have not been completed, the present appearance of the sprayed trees indicates that some of the materials used will prove efficacious and of great value to the orange growers in keeping their groves in good, healthy condition.

THE NEW ORLEANS ANT.[*]

I wish to call the attention of this Commission to an introduced insect enemy that promises within a few years to do enormous damage to the agriculural interests of this State, and which at the same time is going to present a most difficult problem for solution. I refer to the so-called "New Orleans ant," which is already a bad household pest in New Orleans and Baton Rouge, and which has already spread to the towns of Alexandria, Lafayette and Lake Charles and to intermediate territory. This ant cares for and permits the increase of almost every species of plant louse and scale insect, and as the indirect result of its presence thousands of trees and plants in the city of New Orleans have already been killed. The ant does not confine itself to facilitating the increase of other injurious insects, but is itself injurious. The present spring it has destroyed the entire prospective orange crop at Audubon Park, by eating the fruit buds, and last year was the cause of heavy losses to orange growers through Plaquemines and adjacent parishes. It is also guilty of causing the increase of the "poo-a-push,"[†] an insect very injurious to sugar cane. Unless measures are found for the control of this pest, the orange industry of the State is doomed, and eventually the success of the sugar cane industry is likely to be threatened by it. All fruit industries will suffer from its presence. As it destroys or drives out all native species of ants, its appearance in the cotton fields is not unlikely to result in increased damage by the boll weevil. The most active enemy which the boll weevil has in Louisiana is the small "fire ant,"[‡] and the latter may possibly be exterminated or driven out of the cotton fields by the "New Orleans ant."

We have no funds with which to inaugurate an investigation of this pest or to find methods of control, but unless steps are taken very shortly against it, the agricultural interests of the State will pay toll to it to the extent of many hundreds of thousands of dollars.

[*] *Iridiomyrmex humilis* Mayr.

[†] *Dactylopius* sp.

[‡] *Solenopsis geminata* Fab., var.

CATTLE TICK ERADICATION.

Among the many pests that we have to contend with in Lou isiana, there is none that is causing such heavy losses as th cattle tick. In several localities in the State the ticks are s abundant that the raising of cattle has been almost entirel abandoned. The tick has few if any natural enemies to hold i in control, and the agricultural methods employed have resulte in a yearly increase in the number of ticks.

Unless eradicated, the ticks will continue their rate of in crease for years to come, until presently the production of bee and dairy cattle in Louisiana will be an absolute impossibility There has been a remarkable awakening of the Louisiana agriculturists during the past few months to the importance o eradicating the tick completely. We are receiving letters o the subject from cattlemen and farmers all over the State, and many individual farmers have already commenced the work o eradicating the tick on their premises.

As a result of the appropriation of $150,000 by the last Congress for the purpose of assisting the Southern States to eradicate the tick, we have been proffered extensive aid in this work by the Bureau of Animal Industry of the United States Department of Agriculture. One of the conditions under which this aid is offered is that the State of Louisiana must herself devote men and money to this work. No specific appropriation having been made for this work by the Legislature, we can secure this Federal aid, amounting probably to $10,000 or $12,000, only by using a part of the Experiment Station and Crop Pest Commission funds for the work. With the approval of the Governor and Active Chairman of the Commission, your Secretary has made provisional arrangements for commencing this work immediately in co-operation with the Bureau of Animal Industry. It is proposed during the coming week to send Mr. C. W. Flynn, of the Commission staff, in company with Dr. Walter Sorrell, of the Bureau of Animal Industry, to several different localities of the State to determine in which parish the work of eradicating the tick can be undertaken to best advantage. Immediately following the reports of these gentlemen some one parish will be selected and work commenced by placing experts and local inpectors in the parish to study conditions and instruct each and very farmer in the parish how to proceed in order to eradicate he ticks on his premises. It is proposed to make this work argely, if not entirely, educational during the first few months, nd to induce owners of premises, by "moral suasion" rather han by the enforcement of legal measures, to eradicate the ticks.

Regulations for the quarantining of infested premises, etc., vill, however, eventually be necessary for the protection of the armers who have cleared their premises of the ticks, and I vould urge this Commission to adopt such regulations now in rder that they may be invoked when needed. Federal employes, s such, cannot enforce quarantine measures within the State, and it will therefore be necessary for this Commission to adopt and enforce all quarantine regulations necessary to the successful prosecution of this work. Federal employes engaged in the work of tick eradication in Louisiana should be appointed inspectors of this Commission in order that they may have authority to enter premises for inspecting cattle and for enforcing quarantine when such becomes necessary, and I would recommend that provision for such appointments be made at your present meeting.

Respectfully submitted,

WILMON NEWELL, Secretary.

Baton Rouge, La., April 11, 1907.

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State Crop Pest Commission

OF LOUISIANA.

CIRCULAR No. 14. May, 1907.

The Circulars of the State Crop Pest Commission are sent free of charge to all armers and fruit growers of Louisiana who make application therefor.

A SIMPLE PLAN OF ERADICATING THE CATTLE TICK BY THE PASTURE ROTATION METHOD.

ADAPTED TO USE ON THE AVERAGE LOUISIANA FARM.

By Wilmon Newell.

On a great many of the farms in Louisiana, where a variety of different crops are grown and on which a liberal pasture area is available, he simplest method of eradicating the tick lies in a modification of Professor H. A. Morgan's "rotation plan," which is given below.

The plan here outlined is based upon two essential facts: First, that eggs deposited by the female ticks after the arrival of cool weather do not hatch until the following spring; and, second, that all fields which have been in cultivation (as in cotton, corn, sorghum, truck, etc.) during the summer are tick-free on and after the first of December (unless tick-infested cattle have been admitted to them during the summer or autumn, which is not usually the case).

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To eradicate the ticks by this plan the farmer must do two thing First, provide a tick-free pasture to put the cattle in after they ar freed from the ticks during the coming winter, so they can then remai tick-free permanently.

Second, get the cattle themselves free from ticks.

1. GETTING A TICK-FREE PASTURE.

The female cattle tick never deposits her eggs upon the animal; th eggs are laid only on the ground.*

The seed ticks, hatching from the eggs on the ground, if no anima are present for them to get upon, cannot live more than three month in summer, although during the cooler portions of the year they ca survive for a longer time. If all cattle are taken out of a pasture o May 1st, and kept out, all ticks in that pasture will be dead by Augus 15th, that is, the pasture will be "tick-free" by the latter date; if a animals be removed from the pasture on June 1st, the pasture will b tick-free by September 1st; if all animals are removed on July 1st it wi be tick-free October 1st, and if all animals be removed from the pastur on August 1st it will be free of all ticks by February 1st.†

Provide for your tick-free pasture this summer by taking all th cattle out of a pasture for one of the periods indicated above. If ther are two pastures‡ on the farm this is easily accomplished by placing a of the cattle in one of them and leaving the other one empty for th necessary time, being careful to see that the gates are kept locked an no tick-infested cattle permitted to break into or pass through it. Whe there is but one pasture on a farm, it may be necessary to divide it in two parts by making a cross-fence. In such cases the cross-fenc should be so placed that the rain water will drain from the part that to be made tick-free **onto the part in which the cattle are to be kep** for the rest of the summer. This cross-fence should be a double fenc viz., should consist of two fences about ten feet apart so egg-layin female ticks cannot crawl from one pasture to the other. Being for temporary use an elaborate expensive fence is not necessary. A three-wire fence is usually sufficient.

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*For details concerning the life history and habits of the cattle tick the read is advised to consult Circular No. 10 of the Commission, which may be had by applyi to Wilmon Newell, Secretary, Baton Rouge, La.

†Horses, mules and colts, before being admitted to a tick-free pasture, shou be critically examined, *all over*, to see that no ticks are on them. Horses and mul which have access to tick-infested areas should not be allowed to mingle with tic free cattle, nor should they be permitted to enter tick-free pasture or pastures whi are *being* freed of the ticks.

‡If there are more than two pastures on the farm, or if there is any extra ava able grazing land, or woodland that can be turned into pasture eventually, such la should be fenced at once and all cattle kept out of it from July 15th of this year, til next spring, so that next year the farmer will have as much *tick-free* pasturage his farm as possible.

After all cattle have been kept out of the pasture for one of the periods given above, it will be tick-free and will be ready to receive **tick-free** cattle, but all **infested** cattle must be kept out of it so it will be ready to receive the tick-free cattle of the farm in February of next year.

In December we proceed to get all ticks off the cattle by the following simple procedure:

2. "SHEDDING" THE TICKS IN DECEMBER AND JANUARY.

As already stated, all cultivated fields are tick-free in December. At any time between December 1 and 25 take the tick-infested cattle out of the field or pasture they have been in during the latter part of the summer and place them in any corn or cotton field. As the ticks mature on them they will drop off, but on account of the cool weather any eggs that may be laid will not hatch until late in February. By February 15th all ticks will have matured and dropped off the cattle (in the corn or cotton field), **but none will have gotten back onto them.** On February 15th they should be removed from this corn or cotton field, so as to get away before any of the eggs hatch as warm weather comes on. On February 15th they can be placed in any other **tick-free** field (such as another corn, cotton or hay field in which no cattle have been permitted during late summer, fall or winter) for a few weeks and then placed in the pasture which will have been made tick-free during the summer and autumn. Or, on February 15th they can be taken direct from the corn or cotton field, in which they have dropped the ticks, to the tick-free pasture.

The main thing to remember is this: **After your cattle are free from ticks do not let them go over any ground or into any pasture or field unless you KNOW it is tick-free.**

The foregoing will doubtless give the reader a general understanding of how the "rotation method" operates and how easily it can be put into practice. However, to provide against minor conditions and against contingencies which may escape his attention unless he be **thoroughly** informed regarding tick eradication, the farmer should consult more de-

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